SCIENCE ABSTRACTS.

Section A.—PHYSICS.

JULY 1904.

GENERAL PHYSICS.

1585. *Sun-dial for Places where Astronomical Position and Declination are not exactly known.* **H. Maurer.** (Zeitschr. Instrumentenk. 23. pp. 207-209, July, 1903.)—For the meteorological service in German East Africa the author has devised a sun-dial, which is made by A. Meissner, of Berlin, and which has proved useful at twenty stations whose magnetic declination is unknown and whose latitude is only known within half a degree. The instrument is desk-shaped. The dial forms a semi-cylindrical surface, the axis of the cylinder, the style, lying in the plane of the framing. When the style is mounted parallel to the earth's axis a plummet rests against the quadrant plane and marks the latitude on it. There is a notch in the style, producing on the dial a spot of light, whose position is, by turning the instrument, adjusted to the sun's declination for the day according to a table. H. B.

1586. *Fibres resembling Quartz Fibres.* **K. E. Guthe.** (Phys. Rev. 18. pp. 256-262, April, 1904.)—Steatite or soapstone, $Mg_3H_2Si_4O_{12}$, gives very good fibres when fused to a clear bead in an illuminating gas—oxygen blowpipe flame working small and steady, and then drawn. The fibres become brittle if afterwards heated in a Bunsen flame. The fibres show all the characteristic properties of fused quartz, and the material is readily obtained from an old gas-burner (steatite hardened by heat). The fibres are more flexible than those of quartz. A. D.

1587. *Surface Tension of Polarised Mercury.* **G. Kučera.** (Ann. d. Physik, 11. 3. pp. 529-560, June 4, and 11. 4. pp. 698-725, June 22, 1903. Extract of Habilitationsschrift, Leipzig, 1903. Physik. Inst. d. techn. Hochschule, Darmstadt, Dec., 1902.)—For investigating the maximum surface tension of polarised mercury the author uses the drop-weighing method. It is shown that this method is suitable for preparing electro-capillarity curves, as it gives, with acids or concentrated salt solutions, values for the maximum e.m.f. and for the form of the curve in agreement with those obtained by "statical" methods. From the maximum surface tensions is derived the law that the adhesion between water and mercury is increased by salt solutions and with increasing density of the latter; this increase in adhesion takes place at first rapidly and then more slowly. There is possibly a connection between the magnitude of the alteration and the molecular weight in the case of chemically similar salts. The capacity of the polarised electrode has different values, not only for different electrolytes, but also for different concentrations of the same electrolyte. On contact of a fresh mercury surface with a salt solution, processes occur which may cause a secondary maximum on the ascending branch of the electro-capillarity curve. This explains the behaviour of the statical capillary electrometer on ascending this branch of the curve. The author also determines the influence of auto-depolarisation on the values given by a drop-electrometer. T. H. P.

1588. *Toughness and Rigidity in Surface Films.* **K. Schütt.** (Ann. d. Physik, 13. 4. pp. 712–746, March, 1904. Extract from Kieler Inaugural Dissertation, 1903.)—The question of the existence of a superficial toughness in liquids is investigated by means of Coulomb's method. The toughness was not found to exist in the Platean sense of the term. Many liquids, however, are coated with a skin which exhibits the rigidity of a solid. For this the modulus of torsion and the breaking strain were measured, and a limiting value thus found for the thickness of the solid layer. The second part of the paper treats more particularly of the above abnormal behaviour. G. E. A.

1589. *Influence of Temperature and Pressure upon Absorption and Diffusion of Hydrogen through Palladium.* **G. N. S. Schmidt.** (Ann. d. Physik, 13. 4. pp. 747–769, March, 1904. Extract from the Bonn Inaugural Dissertation.)—The palladium in the form of a thin tube 10 cm. long, with walls 0·04 cm. thick, is subjected to the action of the hydrogen, and measurements of the quantities absorbed (or diffused) under different pressure and temperature conditions are made. Tables and curves are given. It is found that above 140° the diffusion and absorption diminish with increasing pressure and temperature. Below 140° results are irregular. J. W. P.

1590. *Forced Vibrations of Rods.* **W. Elsässer.** (Ann. d. Physik, 13. 4. pp. 791–818, March, 1904.)—An analytical and experimental treatment in which the distribution of nodes for various periodicities is worked out. The vibrations (transverse or longitudinal) are produced by tuning-forks attached to the rods. J. W. P.

1591. *Propagation of Waves in a perfectly Elastic Medium affected by Finite Deformations.* **P. Duhem.** (Comptes Rendus, 136. pp. 1379–1381, June 8, 1903.)—In this note a, b, c are the co-ordinates of a point in the undeformed medium, ξ, η, ζ the deformations, $x = a + \xi$, &c. ; Σ is a wave surface of the second order for ξ, η, ζ—l, m, n the direction cosines of its normal. Then the derivatives of the second order $\frac{d^2\xi}{da^2}$, &c., are discontinuous on Σ, and he writes $\frac{d^2\xi}{da^2} = l^2F$, $\frac{d^2\xi}{da\,db} = lmF$, &c., $\frac{d^2\eta}{dy^2} = m^2G$, &c. Hadamard has given the following theorem for the case in which the temperature is invariable throughout the medium, namely : "If at any point a, b, c, ξ, η, ζ, and l, m, n are given, there are only three possible directions for the vector (F, G, H). They are mutually rectangular, and are the axes of a certain quadric $f = 1$, f being a quadratic function of F, G, H. For each of these directions the vector represents a velocity of propagation inversely proportional to the corresponding axis of the quadric." The writer extends Hadamard's theorem as follows : "If the medium is a good conductor of heat, Hadamard's theorem holds even if the temperature is not invariable. But for a non-conductor the quadric, instead of $f=1$, becomes $f+Q^2=1$, in which Q is a linear function of F, G, H, whose coefficients depend on the deformation." Hadamard having shown that his quadric is an ellipsoid, it remains an ellipsoid in the more general case, concentric with and wholly within Hadamard's ellipsoid. The quadrics, he says, generalise for the respective media the laws of propagation of sound given by Newton and Laplace. To the surface Σ referred to the space a, b, c corresponds a surface S referred to x, y, z, which is a wave of the second order for ξ, η, ζ as functions of x, y, z. If α, β, γ be the direction cosines of S, we have $d^2\xi/dx^2=\alpha^2\phi$, $d^2\xi/dxdy=\alpha\beta\phi$, $d^2\eta/dy^2=\beta^2\psi$, &c., and there are only three possible directions for the vector (ϕ, ψ, χ), which, however, are not mutually rectangular. The relations between the vectors (F, G, H) and (ϕ, ψ, χ) are discussed. S. H. B.

1592. *Propagation of Waves in Elastic Media according as they are or are not Conductors of Heat.* **P. Duhem.** (Comptes Rendus, 136. pp. 1537–1541, June 22, 1903.)—In this note the author continues the investigations of the former note [see preceding Abstract]. He supposes a homogeneous deformation, that is, one in which $\xi=a_{11}a+a_{12}b+a_{13}c$, $\eta=a_{21}a+a_{22}b+a_{23}c$, $\zeta=a_{31}a+a_{32}b+a_{33}c$, the coefficients a_{11}, &c., being independent of a, b, c. He then supposes a_{11}, &c., and the temperature T to undergo small variations, constituting a homogeneous perturbation. For instance, in the notation of the preceding note, $\partial a_{11}=\eta l\mathrm{F}$, $\partial a_{12}=\eta m\mathrm{F}$, $\partial a_{13}=\eta n\mathrm{F}$, $\partial a_{21}=\eta l\mathrm{G}$, &c., η being an infinitely small quantity. The quadrics of the last note become then $\mathrm{F}=\eta^2\partial_{\mathrm{T}}\tau$, $\mathrm{F}+\mathrm{Q}^2=\eta^2\partial_{\mathrm{Q}}\tau$. It is shown that $\partial_{\mathrm{T}}\tau$ and $\partial_{\mathrm{Q}}\tau$ are positive. If the medium is fluid $\frac{d_{\mathrm{Q}}\tau}{d_{\mathrm{T}}\tau}=\frac{\mathrm{C}_p}{\mathrm{C}_v}$, C_p and C_v being the two specific heats of the fluid. From these data the writer calculates the velocities of propagation, according as the fluid is or is not a conductor of heat, and applies the result to a vitreous medium. S. H. B.

1593. *On Wave Partitions.* **P. Duhem.** (Comptes Rendus, 137. pp. 237–240, July 27, 1903.)—The writer refers to his demonstration in a former memoir that in a viscous fluid no waves can exist except waves which continue to separate always the same parts of the fluid [see Abstract No. 13 (1904)], and he has extended the same theorem to elastic media of all kinds, free from viscosity, but which may be vitreous or crystalline, subjected to finite or very small deformations. Such a medium is divided by the waves in question, as by air-tight partitions, into compartments, mutually exclusive, so that no matter can pass from one to another. In the present paper are considered the quadrics of pressure represented by the equations—

$$(\mathrm{N}_x+\nu_x)\mathrm{X}^2+(\mathrm{N}_y+\nu_y)\mathrm{Y}^2+(\mathrm{N}_z+\nu_z)\mathrm{Z}^2$$
$$+2(\mathrm{T}_x+\tau_x)\mathrm{YZ}+2(\mathrm{T}_y+\tau_y)\mathrm{XZ}+2(\mathrm{T}_z+\tau_z)\mathrm{XY}=1,$$

in which the coefficients of X^2, &c., correspond to normal and tangential pressures. If M be a point in a partition wave, the quadric tends to assume one of two limiting forms, according to the side from which we approach it. But it is found that "The diametral plane conjugate to the normal of the partition wave has the same orientation in both limiting quadrics"; also that "The intersection of the partition wave of the first order with respect to the velocities with the bounding surface of the medium forms a discontinuity on that surface which may be salient or re-entrant." The note ends with references to experiments made by Bénard, Cartaud, and others, of which the property above demonstrated appears to give a satisfactory explanation.

S. H. B.

1594. *Some Problems of Elastic Equilibrium.* **L. Orlando.** (N. Cimento, 7. pp. 161–165, March, 1904.)—For isotropic bodies, and under the hypothesis that the external forces are zero, the problems discussed by the writer depend on the integration of the equations $(\lambda + \mu)\frac{d\theta}{dx} + \mu\Delta^2 u = 0$, $(\lambda + \mu)\frac{d\theta}{dy} + \mu\Delta^2 v = 0$, $(\lambda + \mu)\frac{d\theta}{dz} + \mu\Delta^2 w = 0$, in which $\theta = \frac{du}{dx} + \frac{dv}{dy} + \frac{dw}{dz}$, and λ, μ are the two constants in the theory of elasticity of isotropic bodies. In the present paper he considers an isotropic body bounded by plane faces, and the two cases in which (1) the tangential components of displacement and the normal component of tension, (2) the tangential components of tension and the normal component of displacement, are given at each point on the surface. In case (1) we may take one of the bounding planes for that of xy, and let N be the normal tension. Then we have $N = -\lambda\left(\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} + \frac{\partial w}{\partial z}\right) - 2\mu\frac{\partial w}{\partial z}$, in which $\frac{\partial w}{\partial z}$ is the only unknown quantity. Hence he finds—

$$\theta = \frac{1}{\lambda + 2\mu}(-N + 2\mu)\left(\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y}\right).$$

But, he reasons, since the cubic dilatation is unaffected by change in the axes of x, y, z, we may find θ in the same way for each of the bounding planes. But θ is a harmonic function. Therefore the problem is reduced to that of Dirichlet. The second case is dealt with on the same lines. S. H. B.

1595. *Whirling and Transverse Vibrations of Rotating Shafts.* **C. Chree.** (Phil. Mag. 7. pp. 504–542, May, 1904. Communicated by the Physical Society.)—A mathematical discussion of the problem under the following heads: Overhanging shaft, end fixed in direction; shaft supported at both ends; overhanging shaft supported at one end and at another point; shaft supported at one end and with its direction fixed at the other end; shaft supported at both ends and at an intermediate point; shaft fixed in direction at both ends. J. W. P.

1596. *Effect of Small Oscillations of External Action on Systems Affected with Hysteresis and Viscosity.* **P. Duhem.** (Comptes Rendus, 138. pp. 1075–1076, May 2; and pp. 1196–1199, May 16, 1904.)—In the first of these notes the author, after referring to a former paper [see Abstract No. 1248 (1904)], supposes the changes of sign of X to involve those of x. He gives the following conclusion: "If the amplitude $(A_0 - A_1)$ of the oscillation of X is small compared with v the coefficient of viscosity, the velocity of transformation of x (denoted by x') cannot continually change sign in consequence of the changes of sign of x, at all events unless x' be always nearly zero." From which and the former paper is deduced the further conclusion that "small oscillations of external action have only an inappreciable influence on the transformations of a system whose coefficient of viscosity is great compared with the amplitude of the oscillations." Reference is made to the experiments of Lenoble and Bouasse and others on metals and vulcanised indiarubber in which remarkable viscosity was found conjoined with hysteresis. In the second note the writer refers to the fact that in his preceding papers on the same subject the temperature was assumed to be constant. In the present case it is supposed to oscillate, always remaining near a mean value T_0, as does X about X_0. He finds in this case that "The transformation takes place with a speed sensibly the same whatever be the law of the oscillations of X and T about X_0 and T_0, in fact with the same speed as if X and T were invariable." Or "Small oscillations of external force and temperature have no appreciable influence on the transformations of a system so long as the coefficient of viscosity is great compared with the amplitude of the oscillations." S. H. B.

1597. *Curves of the Paths of Air in a Special Type of Storms.* **W. N. Shaw.** (Monthly Weather Rev. 31. pp. 318–320, July, 1903.)—When the centre of a storm travels, the actual path or trajectory of an isolated mass of air will be that described by a point which rotates with an appropriate incurvature about the moving centre. Assuming the speed of the air to be uniform, and the isobars to be true circles, the author arrives at the equation—

$$(a-y)(2a+y)^2 = 9ax^2$$

for the trajectory of a point rotating with uniform linear speed about a centre moving with the same speed. The equation represents a curve with a double point and a symmetrical loop about it. If the storm path be west to east, the central area will be fed by winds from S.S.W. to W., passing to a region in front of the storm centre; corresponding winds will blow out from behind the centre with directions from W. to N.N.W.; the winds from the remaining directions will be comparatively transient, and will be represented by the loops of the curve; no air will be taken into the storm area from the northern side; there will be a convergence behind the centre to the points on the line of the trough, associated with a divergence in front of the trough and apparent crossing of the trajectories at the trough itself. The observations of the storm of February 26–27, 1903, made and mapped at the Meteorological Office by Lempfert and Brodie, confirm these conclusions on the whole. Where there is convergence the air must rise, where divergence, it must descend; the wind in front will be supplied from above, and the motion behind the trough will be upward and will produce rain. H. B.

1598. *Annual Variations of Insolation.* **L. Gorczyński.** (Acad. Sci. Cracovie, Bull. 7. pp. 465–502, July, 1903. Varsovie, Station Centrale Météorologique (Musée de l'Industrie et de l'Agriculture), May, 1903.)—In the two years December, 1900, to December, 1902, the author has, at Warsaw, on 180 days made 4,638 observations with an Ångström-Chwolson actinometer, each observation taking 2½ min. and comprising ten readings. He further analyses the records compiled by Schukewitsch and by P. Müller for Pavlovsk, St. Petersburg, and Katherinenburg. Readings were taken with the sun at altitudes of 9, 12, 15, 18, 24, 30, 40, 45, 50°, and the values reduced to the mean altitude of 30° and to the mean distance of the earth from the sun. From the results the author selects the highest figures for the same altitude and distance and the same absolute humidity (Assmann psychrometer), as least affected by accidental features, transparency of the atmosphere, &c., and he thus arrives at the coefficient of humidity reduction, which is 0·018 for Warsaw, *i.e.*, when the absolute humidity increases by 1 mm., the mean insolation diminishes by 0·018 gm.-cals. per sq. cm. per min. The coefficient for Pavlovsk is 0·021, for St. Petersburg 0·024. At Warsaw the mean monthly insolation is greatest in April (1·41), remains steady (at 1·40) till July, attains a secondary maximum in September (1·33), and has its minimum in January (1·01); these are the values for 1901. In 1902 smaller values resulted, especially for June and July. The curves for Pavlovsk and also for St. Petersburg are very similar, and have their maxima also in April, but the values for St. Petersburg are all lower, which may be a town effect, and for Katherinenburg higher. The author concludes that above 70° the insolation curve should, owing to the small absolute humidity, coincide with the altitude of the sun and have its maximum in June, while at Peking, where the absolute humidity varies between 2 mm. in January and 18 mm. in July, the maximum insolation should fall in March and the minimum in July. H. B.

1599. *Values of Certain Meteorological Quantities for the Sun.* **F. H. Bigelow.** (Monthly Weather Rev. 32. pp. 71–78, Feb., 1904.)—From F. E. Nipher's equations (Law of the Contraction of Gaseous Nebulæ) the author deduces values for the meteorological quantities of the sun. The gases of the envelope (comprising the reversing layer, the chromosphere, and the inner corona) resting upon the photosphere are assumed to approximate perfect gases. If the pressure P of a solar hydrogen atmosphere be 5 atmospheres in the reversing layer where the temperature T is 7,579° C., then the pressure P within the photosphere, where T is 7,652°, would be 28 atmospheres, and the density $\rho = 0·089998$; at the top of the inner corona, the values for P, T, and ρ would be 0·001, 7242, 0·000004. With the aid of a transformation factor from perfect gases to the materials within the photosphere, the author further calculates a table of thermodynamic values. H. B.

1600. *Cyclonic Movements and Compound Centrifugal Force.* **B. Brunhes.** (Comptes Rendus, 138. pp. 1093–1095, May 2, 1904.)—Hann has given the equation for vortex movements, $\Delta B \sin \alpha = 1076\left(2\omega v \sin \phi + \frac{v^2}{r}\right)$, where ΔB is the pressure gradient in millimetres of mercury per degree of 111 km., α the angle between the wind direction and the normal to the isobar, ω the angular velocity of the earth, ϕ the latitude, v the wind velocity, and r the distance of the point in question from the centre of the whirl. In our latitudes the first term in the bracket (the compound centrifugal force) predominates over the second, their respective values being, for instance, 2·67 and 0·35 mm.; in the tropics the centrifugal force proper (the second term) is stronger, the two values being, *e.g.*, 2·09 and 10·21 mm. In Europe, therefore, the compound centrifugal force decides the sign of the gradient; if the rotation is left-handed, the gradient is positive towards the exterior, and there is depression at the centre; if right-handed, the conditions are anticyclonic. When the centrifugal force proper prevails, the sign of the gradient is constant and independent of the sense of the rotation, and the conditions are cyclonic. But the first term will always favour left-handed cyclones in the northern hemisphere. Eliminating v and r, and introducing the time occupied by one vortex rotation, the author finds that left-handed rotations will predominate in the northern hemisphere if the rotation is accomplished in 5 or 10 sec.; for very short periods, especially periods of less than 1 sec., the sense of rotation is indifferent. This should also hold for water whirls, although their dimensions are very small. H. B.

1601. *Solar Eclipse of May 28, 1900. General Discussion of Spectroscopic Results.* **J. Evershed.** (Communicated by the Joint Permanent Eclipse

Committee. Roy. Soc., Proc. 71. pp. 228–229, Feb. 13, 1903; Roy. Soc., Phil. Trans. 201. pp. 457–496, July 15, 1903.)—The instrument used was an ordinary reflecting telescope of 188 cm. focus, fitted with two light flint prisms with an effective aperture of 8 cm. and angles of 60° and 45° respectively. A linear dispersion was obtained of 93 mm. between F and K. The plates were exposed near the time of greatest phase of the eclipse, which was not quite total. The first plate was exposed at 45 sec. before and the last 32 sec. after the computed time of mid-eclipse. An examination of the negatives showed that every strong dark line of the solar spectrum exceeding Rowland's intensity 7 is found in these spectra as a bright line; and the great majority of the bright lines of the flash spectrum, excluding hydrogen and helium lines, coincide with dark lines of intensity not less than 3. Most of the bright lines of the flash spectrum were well-defined narrow arcs admitting of considerable accuracy in the measures and in all probability the coincidences of the bright lines with the dark lines are exact within 0·05 A.U. for all the well-defined lines. The relative intensities of isolated lines of an element in the flash spectrum are in general, but not exact, agreement with those of the same element in the solar spectrum, and those lines which are exceptionally strong in the flash are in most cases lines which are enhanced in the spark spectrum of the element. All of the more prominent enhanced lines of iron and titanium are found to coincide with strong lines in the flash, but owing to the compound nature of some of these lines it is not certain that all of these have abnormal intensities in the flash. There is no evidence of differences in the relative intensities of the lines of an element in the higher or lower regions of the flash layer, and the enhanced lines appear to predominate throughout the entire depth of the radiating stratum. The enhanced lines are equally prominent in the polar regions and in low latitudes, and the flash spectrum generally is found to be the same in all latitudes and shows no essential change after an interval of five years. The abnormal intensities of the enhanced lines in the flash is explained on the assumption of a continuous circulation of the solar gases in a radial direction; the highly heated ascending gases giving the predominant features to the flash spectrum, whilst the cooler, more diffused gases, slowly subsiding, determine the character of the absorption spectrum. In conclusion, the author considers that the flash spectrum represents the emission of both ascending and descending gases, while the Frauenhofer lines represent the absorption of the descending gases only. A table is given of the wave-lengths measured between $\lambda = 3488$ and $\lambda = 5040$ and also of the hydrogen lines, showing the agreement with the values found from Balmer's formula $\lambda = \frac{m^2}{a(m^2 - 4)}$, where $a = 27418{\cdot}75$. E. C. C. B.

1602. *Temperature Classification of Stars.* **N. Lockyer.** (Roy. Soc., Proc. 73. pp. 227–238, April 9, 1904.)—The paper contains a discussion of a series of photographs of stellar spectra specially taken to determine the extension of the continuous radiation, both in the ultra-violet and red, this giving a criterion as to the probable relative temperatures of the stellar atmospheres. The instrument employed was a quartz-calcite train, having a 2-in. objective of 18 in. focal length and a single calcite prism with the outer face perpendicular to the optical axis of the crystal, thereby eliminating double refraction and doubling of the spectrum lines. The stars examined are arranged in the order thought to be representative of sequence of temperature, and an accompanying plate shows the comparisons of nine pairs of stellar spectra, each pair having been photographed on the same plate on the same night, with the respective stars at almost identical altitudes, so as to eliminate, as far as possible, the variations in absorption due to the influence of the terrestrial atmosphere. C. P. B.

1603. *Aurora Spectrum.* **E. C. C. Baly.** (Astrophys. Journ. 19. pp. 187–189, April, 1904.)—The latest measures of the aurora spectrum, made from photographs obtained by Sykora at Spitzbergen in 1899 are compared with lines of similar wave-length in the spectrum of krypton, produced by an induction spark on the gas in an exhausted tube. The krypton lines are given with much greater accuracy than those of the aurora, owing to the difficulty of observing the latter. From the apparent coincidences of the constituent wave-lengths it is considered as probable that a close connection exists between the two spectra. [See Abstract No. 74 (1904).] C. P. B.

1604. *Spectra of Antarian Stars in Relation to the Fluted Spectrum of Titanium.* **A. Fowler.** (Roy. Soc., Proc. 73. pp. 219–225, April 9, 1904.)—The spectra of the red stars, of which Antares, α Herculis, and o Ceti are typical examples, have hitherto had no definite interpretation with regard to the identification of their chemical constitution. The present inquiry was suggested by the remarkable similarity in structure presented by the fluted spectrum of titanium with that seen in the stellar spectra. The lack of accurate wave-length measurements does not materially affect the view of this explanation, as the number of comparisons throughout the spectrum is very great. The titanium spectrum was obtained by the use of the electric arc, taking care to employ plenty of material and a long arc. Titanium oxide was used, but the same flutings can be obtained from the chloride under similar conditions. The best representation of the flutings has been obtained by passing the spark, without condenser in circuit, through the fumes of oxychloride which are emitted from the chloride of titanium on exposure to air. The paper is illustrated by a reproduction of a photograph of titanium obtained with a Littrow spectroscope, having one prism of 60° through which the light passes twice, and a 2-in. lens of 40 in. focal length, giving a linear dispersion of 5 in. from D to K. Various tables are given showing the comparison of the wave-lengths of the titanium flutings with those of the best measures of the flutings in the stellar spectra. C. P. B.

1605. *Stars having Peculiar Spectra.* **E. C. Pickering.** (Astrophys. Journ. 19. pp. 287–289, May, 1904.)—A list is given containing particulars of 22 stars which have been found to have peculiar spectra by examination of the photographs obtained with the *Henry Draper Memorial* telescope and objective prism at Harvard College Observatory. It has also been found that the variable star R.S. Ophuchi has a spectrum of the third type in which the lines H_β, H_γ, H_δ, H_ϵ, and H_ζ are bright. Two other bright lines are also present, apparently coincident with the bright lines in γ Velorum, whose wave-lengths are 4656 and 4691. These are interesting from the fact that no other *variable* star having this type of spectrum has hitherto been found. C. P. B.

1606. *Variable Stars in the Nebula of Orion.* **E. C. Pickering.** (Astrophys. Journ. 19. pp. 289–295, May, 1904.)—Examination of the Harvard photographs of the region of the nebula of Orion has resulted in the confirmation of 16 of

Wolf's variables, and the discovery of many new ones. A list of these is given, their distribution emphasising their close connection with the nebula. They are found principally in a narrow region on each side of a line extending southward from *C Orionis* through θ and ι, and beyond. North of declination $-4° 44'$ only one variable was found out of about 900 stars examined.

C. P. B.

REFERENCES.

1607. *Influence of Stiffness upon the Form of a Suspended Wire or Tape.* **R. C. Maclaurin.** (Phil. Mag. 6. pp. 166–173, July, 1903.)—A mathematical treatment of the correction to be applied in a surveyor's tape or wire. Arithmetical applications are given. J. W. P.

1608. *The Ascent of Sap.* **H. H. Dixon.** (Roy. Dublin Soc., Proc. 10. 4. pp. 48–61, June 5, 1903.)—Discussion of certain objections to the cohesion theory of the author and Joly (Proc. Roy. Soc., Nov. 15, 1894), raised by Steinbrinck (Ber. Deutsch. Bot. Gesell., 1900) and by Copeland (Bot. Gaz., Sept., 1902). Air dissolved in the sap does not tend to the formation of air-bubbles by the rupture of tensile liquid. Plaster of Paris continues to absorb water for a long time after it has set. This absorption may set up local differences of pressure, which the impermeability of the plaster will maintain for long periods. A. D.

1609. *Relation between Work and "Static" Work of Equivalent Energy.* **C. Henry** and **J. Ioteyko.** (Comptes Rendus, 137. pp. 1285–1288, Dec. 28, 1903.)—The value of the static work is obtained by Coulomb's method. Firstly, an ergogram is received on a rapidly revolving cylinder, the rhythm being 150 contractions to the minute, and secondly, a weight is sustained during a known time. Results obtained by the authors show that the dynamic work increases proportionally with the static work of equivalent energy, the coefficient of proportionality being $\frac{1}{120}$.

H. W. P. Y.

1610. *Diffusion and Viscosity.* **J. Thovert.** (Comptes Rendus, 138. pp. 481–482, Feb. 22, 1904.)—The coefficient of diffusion of phenol in a large series of solvents varies inversely as the viscosity; and the coefficients of variation of viscosity and of diffusion with change of temperature are about equal. A. D.

1611. *Air Movements within Areas of High and Low Pressure.* (Monthly Weather Rev. 31. pp. 339–340, July, 1903.)—This is a reproduction of the conclusion arrived at by P. Polis in his dissertation (Deutsche Seewarte, Archiv xxii.) from cloud and wind observations taken at Hohenschwand, Carlsruhe, Breslau, Schneekoppe, Aachen, and Furnes (Belgium), and also at eight other stations. Van Bebber, to whom Polis refers, summed his views up in fourteen theorems; Polis has thirty-four conclusions concerning the angular deviation of the wind from the gradient (normal to the isobars), the influence of high and low pressures, season, elevation, distance of the sea-shore, distance of the cyclone from the station, wind velocity, feeding of the storm centre at different altitudes, coefficient of friction on the earth surface, &c.

H. B.

1612. *Bigelow's Studies on the Circulation of the Atmosphere.* **A. Woeikof.** (Monthly Weather Rev. 32. p. 118, March, 1904.)—The author suggests that the best means to detect an influence of a change of solar radiation on the temperature of the atmosphere would be the determination of the difference of pressure between tropical heights and the lowlands at their base, as proposed by Hann. Records from India and Ceylon (1873–1900) and also from Peru and Hawaii might be utilised.

H. B.

1613. *The Weather Bureau Seismograph at Washington.* **C. F. Marvin.** (Monthly Weather Rev. 31. pp. 271–275, June, 1903.)—Description of the Omori horizontal pendulum, made by Bosch, of Strassburg, installed at Washington in 1892 and recently improved, with notes on the theory. H. B.

1614. *Diffusion of Vapour into Nucleated Air.* **C. Barus.** (Amer. Journ. Sci. 15. pp. 472–476, June, 1903. Paper contributed to the meeting of the National Academy, April, 1903.)—The results of experiments on the diffusion of vapour, especially water vapour, are given. The feature of the curves, showing the advance of diffusion at a given height in a tall glass vessel, or at a given time, is the extreme slowness of diffusion. The diffusion of the vapour and not of the nuclei was observed. The nuclei must diffuse much more rapidly than the vapour, but a measurement of their diffusion was not obtained by the direct method employed. J. J. S.

1615. *Atmospheric Formic Acid.* **H. Henriet.** (Comptes Rendus, 136. pp. 1465–1467, June 15, 1903.)—The author has shown that there exists in the atmosphere a neutral gaseous body apparently consisting of a base containing nitrogen in combination with formic acid [see Abstracts Nos. 266, 267 (1903), and 735 (1904)]. The present paper describes the author's method of experimentally establishing this fact, and of determining the amount of formic acid present. The latter is to be found in meteoric waters, particularly in that obtained by the condensation of mist, and also in gases emanating from the soil, where it is probably formed by the oxidation of organic matter. In every case the acid is combined with a base containing nitrogen, and in the form of a neutral compound. J. D. C.

1616. *Vertical Component of the Wind.* **M. Dechevrens.** Comments by **C. Abbe** and **C. F. Marvin.** (Monthly Weather Rev. 32. pp. 118–121, March, 1904.)—On an iron tower, 50 m. in height, of the St. Louis Observatory, Jersey, Channel Islands, the author has put up a compound anemometer, which is 111 m. above sea-level. A horizontal arm supports at the one end an anemometer whose cups are replaced by straight semi-cylinders, which cannot be affected by the vertical component, and at the other end an inclined blade anemometer, which responds only to vertical currents, ascending and descending currents being separately registered in a box underneath by electrical devices. Two small windmill wheels are further fixed under the bar, in planes at right angles to it; these indicate the wind direction, and turn the bar so that both the anemometers face the wind. The instrument was made by Richard and put up in 1894. The author gives hourly averages for the two years ending September, 1903. With a steady horizontal component of about 25 km., there was an ascending current, increasing from 2,708 m. at about 5 a.m. to 3,119 at 1 p.m., and a descending current varying between 32 and 130 m.; the maxima of the ascending and descending velocities both occur soon after noon, and their ratio is 4 : 1. C. Abbe points out that this ratio is improbable; the volumes of the ascending and descending air should be the same, but the rapid descent is checked near the earth surface, and such observations which are of importance should be made at higher elevations. C. F. Marvin adds that he tried the instrument in 1894 at Washington, where it was only 40 ft. above the roof of the Weather Bureau building, however. The instrument was not sufficiently sensitive, and even under better conditions it would be almost impossible to avoid a slight tilting of the axis of the inclined blade anemometer and a want of symmetry in the blades; in both cases the anemometer would be turned also by horizontal currents. H. B.

1617. *Atmospheric Temperature at the Summit of Monte Rosa.* **E. Oddone.** (Accad. Lincei, Atti, 13. pp. 400–408, April 24, 1904.)—The author first discusses three different methods of arriving at the probable mean monthly temperatures at Monte Rosa (4,560 m. above sea-level), and, applying these, compares them with observed results from 1866 to 1900. The results are then discussed. L. H. W.

1618. *Equations of the New Copies of the Metre.* **J. Bosscha.** (Archives Néerlandaises, 9. pp. 108–124, 1904.)—The errors due to temperature, &c., are considered, and the various copies compared. J. W. P.

1619. *Errors of Kite Meteorographs and of Mountain Observations.* **H. H. Clayton.** (Monthly Weather Rev. 32. pp. 121–124, March, 1904.)—The author discusses the sources of error due to the instruments' exposure to radiation, &c., reading the meteorograms (time errors), and others, with special regard to the Fergusson, Marvin, and Richard meteorographs employed at the Blue Hill Observatory, and the checking applied. Particular attention is drawn to the fact that temperatures on hills and mountains seem generally to be lower than the temperatures of the free air at the same level. At Blue Hill observations are taken at 15, 78, 195 m. above sea-level (valley station, tower 30 m. in height, top of hill); during daytime there is only a slight difference in temperature, unless under cyclonic conditions, but at night the top may be 7° F. colder than the free air. [See also Abstract No. 1272 (1904).] H. B.

1620. *Temperature of the Earth and Precession of the Equinoxes.* **J. Péroche.** (Revue Scientif. 1. pp. 579–583, May 7, 1904.)—The author believes that the northern hemisphere enjoyed the warmest climate about 1250 A.D., and that we can trace the climatic movement in the spreading northward of vines up to this date and their receding again after the thirteenth century. The temperature records of Lille for the period 1757–1882 show that the winters had become warmer by about 1·3°, the springs colder by 1·8°, the summers colder by 1·5°, and the autumns warmer by 1·5°; the mean annual temperature had decreased from 10·12° to 10·00°. The months of April and of September-October show the smallest changes. Those seasonal changes are connected with the predominating wind directions, winds from the N. and N.E. prevailing in spring and summer, and from the W. and S.W. in autumn and winter. The rainfall at Lille had increased from 663 mm. in the twenty years ending in 1852, to 740 mm. in the period 1883–1902. H. B.

1621. *Regions of Seismic Instability, Oceans, and Coasts.* **F. de Montessus de Ballore.** (Archives des Sciences, 15. pp. 640–660, June, 1903.)—The author criticises J. Milne's "Seismological Observations and Earth Physics" (Geograph. Journ., Jan., 1903) and his grouping of the earthquake origins in twelve regions, based, the author maintains, solely on the examination of the 208 earthquake records of 1899 to 1901. Though the preliminary tremors were propagated with a fairly uniform speed, the speeds of the other phases were not sufficiently regular to allow of any conclusions to be drawn. Examining Milne's groups A, B, &c., with regard to E. Rudolph's "Submarine Erdbeben," and to his own studies, the author does not find sufficient coincidence between these regions and the zones of geological instability. Milne had, moreover, overlooked certain earthquake centres—which are, however, marked on Milne's map, reproduced by the author—and his leading idea, correlation between earthquakes and lines of corrugation, had already been enounced by the author in 1895. H. B.

1622. *Hecker's Determination of Gravitation on the Atlantic Ocean.* (Monthly Weather Rev. 31. p. 336, July, 1903.)—This is a summary of the results of Hecker's measurements [see Abstract No. 1240 (1904)], published by Helmert in the report of the Geodetic Institute of Prussia, 1902–3. The excess of pressure shown by the mercury barometer over that shown by the thermo-hypsometer is greater when sailing over the shallow part of the ocean than when sailing over the deep sea. On the journey southward this excess, expressed in mm. of mercury, was $+0{\cdot}017 \pm 0{\cdot}015$; on the return journey, $+0{\cdot}048 \pm 0{\cdot}034$. Combining these values, g would be greater over the shallow sea than over the deep sea by $(+0{\cdot}028 \pm 0{\cdot}018)$ cm.; this would be a deviation of 0·003 per cent., of no importance to the meteorologist. H. B.

1623. *Application of Fluorescein for Subterranean Hydrology.* **E. A. Martel.** (Comptes Rendus, 137. pp. 225–227, July 20, 1903.)—Even concentrated solutions of fluorescein are discoloured by sunlight within 24 hours, while in the shade highly diluted solutions will keep their colour for a week. The colouring matter does not settle and is not precipitated by clay; but clay interferes with the colour—less, however, in water under pressure (in caves) than in the open air. Turbid water samples should be filtered, as the fluorescein passes through the filter. In still water the colour spreads slowly, perhaps 12 m. per hour; in flowing water it seems sometimes to travel less fast than the current. The whole of the fluorescein should be applied all at once, not in small doses. H. B.

1624. *Colour of Lakes.* **O. d'Aufsess.** (Ann. d. Physik, 13. 4. pp. 678–711, March, 1904. Extract from the Münchener Inaugural Dissertation, 1903.)—A more complete account of the author's researches noticed in Abstract No. 996 (1904). The relations between transparency, colour, and temperature of the water are discussed; the colour affects the temperature, the temperature does not affect the colour. It is not necessary to make comparative transparency observations always under the same conditions of the sky; the author found with his white disc, 1 m. in diam., the same transparency value at noon with a cloudless sky, and after sunset To study the influence of organic compounds which turn the colour into yellow, he filtered water through vegetable earth, and determined the amount of soluble organic matter in the lake water. H. B.

1625. *Transmission of Earthquake Waves.* **O. Fisher.** (Cambridge Phil. Soc., Proc. 12. pp. 354–361, April, 1904.)—The disturbances are supposed to be caused by a relaxation of pressure of the earth's crust upon the subjacent magma. To explain the phenomena, the problem of the effects in a liquid just saturated with gas is considered mathematically, and values for the velocities of the liquid and gaseous waves are found. The considerations and results tend, in the author's opinion, to the theory of a liquid interior for the earth. J. W. P.

1626. *Variable Star* 6871 *V Lyræ.* **J. A. Parkhurst.** (Astrophys. Journ. 18. pp. 33–49, July, 1903.)—The variability of this star, first announced by Anderson in 1895, has been examined by the writer with the 15·7-cm. reflector, and 30·5- and 101-cm. refractors, at the Yerkes Observatory during the period 1893–1900. An equalising wedge photometer was employed for the determinations of magnitude, and the co-ordinates for the star's position were measured with a filar micrometer. A curve is given showing the observed changes in magnitude from 1896–1903. The maximum varies from 9·0 to 10·5; the minimum is about 15·4, but is somewhat uncertain, depending on good observations of one minimum epoch only. C. P. B.

1627. *Probable Relationship between Solar Prominences and Corona.* **W. J. S. Lockyer.** (Nature, 68. pp. 257–259, July 16, 1903.)—The paper contains an account of a communication to the Royal Astronomical Society, dealing with an investigation as to the probable relationship between the changes of position of the centres of prominence action and the various forms of corona as observed during total solar eclipses. The forms of corona hitherto observed may be divided generally into three classes according to the distribution of the streamers, polar, intermediate, and equatorial, and these are tabulated with the corresponding centres of prominence action as recorded at similar times. C. P. B.

1628. *Spectroscopic Binary, ι Pegasi.* **H. D. Curtis.** (Astrophys. Journ. 19. pp. 212–219, April, 1904.)—The paper gives the definitive orbit of the spectroscopic binary ι Pegasi, which was discovered at the Lick Observatory in 1899. Measures for the computation have been obtained from 43 plates of the spectrum of the star, taken during the period October 7, 1897, to December 1, 1903. C. P. B.

LIGHT.

1629. *Anomalous Dispersion of Gases.* **O. Lummer** and **E. Pringsheim.** (Phys. Zeitschr. 4. pp. 430–431, May 1, 1903. Deutsch. Phys. Gesell., Verh. 6. 6. pp. 151–152, March 30, 1904.)—A method of demonstrating anomalous dispersion in gases is described, an oxygen blow-pipe or an arc being employed, the carbons for the latter both pointing obliquely downwards. The incandescent vapour is obtained in prismatic layers suitable for exhibiting the phenomenon. Salts of Na, Th, Sr, Ca, and Ba, were examined. [See also Abstract No. 1374 (1904).] In the second paper the demonstration of the phenomenon is described, and additional lines observed in Cr, Mg, Sr, Na, and Ca are recorded. G. E. A.

1630. *Refractive Index of Gases and Temperature.* **G. W. Walker.** (Roy. Soc., Phil. Trans. 201. pp. 435–455, July 14, 1903; Roy. Soc., Proc. 71. pp. 441–442, April 30, 1903. Abstract.)—Jamin's method was employed to examine the gases air, H, CO_2, NH_3, and SO_2, between 10° and 100° C. Careful measurements of the refractive indices show that the temperature coefficients of the refractive index are somewhat less than the values obtained by Mascart, and more nearly equal to the respective coefficients of expansion of the various gases. G. E. A.

1631. *Theory of Refraction in Gases.* **G. W. Walker.** (Roy. Soc., Proc. 72. pp. 24–25, July 8, 1903. Abstract.)—The author adopts the view that the gaseous atom consists of a large positive particle and a large number of small negative ones rolling on the positive one in constrained motion. When, by collisions or otherwise, the rotational motion becomes so great that the electrical attraction is overcome by centrifugal force, ionisation occurs. A formula is obtained which is capable of accounting for all the known facts connected with the dielectric constant and the refractive index, while the absorption of ultra-violet rays and apparent absorption, due to selective reflection in the infra-red, are also explained. G. E. A.

1632. *Aberration of the Objective Concave Grating.* **F. L. O. Wadsworth.** (Phil. Mag. 6. pp. 119–156, July, 1903.)—The concave grating has recently been employed for astronomical research in other arrangements than that of the standard "*normal spectrum*" method originated by Rowland. The chief of these is where the slit is dispensed with, and the radiation from a star or the solar chromosphere during a total eclipse is allowed to fall directly on the ruled concave surface of the speculum, the spectrum being in this case brought to focus at a distance of about half the radius of curvature. The whole of the conditions are altered, however, and, after a rigorous analysis of the various details, the author concludes that the concave grating cannot be advantageously used in this manner for accurate measurements, both on account of the impaired definition of the spectrum lines, and the variability of the scale. C. P. B.

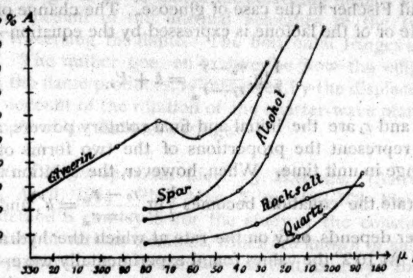
1633. *Refraction in Photometric Apparatus.* **E. Brodhun** and **O. Schönrock.** (Zeitschr. Instrumentenk. 24. pp. 70–74, March, 1904. Communication from the Physikalisch-Technische Reichsanstalt.)—The effect of refraction on the disappearance of the separation line of the divided field of view in apparatus employing the principle of photometric comparison is not sufficiently regarded in practice. The paper describes the necessary precautions to be taken to obviate this defect in the polarimeter half-shadow apparatus, the biprism and the Lummer-Brodhun spectrum photometer. G. E. A.

1634. *Landscape Three-Colour Photography.* **W. de W. Abney.** (Photographic Journ. 44. pp. 81–88, March, 1904. Traill-Taylor Memorial Lecture.) —Rotating coloured sectors may be prepared which are available for selection of screens for all kinds of plates. A plan is described by which the luminosity of a paper is arrived at, and also its composition in terms of the three colours used for projection. A monochromatic beam is divided into two parts which are thrown on a screen, two strips of light being formed by a rod interposed as in a Rumford photometer. The luminosity of the two strips is equalised by means of a rotating sector, first with both strips of light on white paper, and second with one of the strips received on the coloured paper under examination. Details of the exposure and of the production of transparencies by means of spectral light are gone into, and a simple triple-projection lantern is described. G. E. A.

1635. *Testing of Photographic Lenses.* **S. D. Chalmers.** (British Optical Journ. 3. pp. 159–164, March, 1904. Paper read before the Optical Society.) —Setting aside defects due to colour, lenses may suffer from spherical or zonal aberration, coma, astigmatism, distortion, or loss of light due to absorption or reflection. The testing methods are classed in four groups. The first method consists, in principle, in examining the image of a small source directly or by photographic means; the second aims at determining the positions of the best images formed of object points; in the third the positions of the object which give the sharpest images on the plane of the photographic plate are determined; and the fourth method determines the paths of the various rays through the system. These principles are variously applied in the "tourniquet," in the Kew tests and in the Beck bench. Hartmann's method of determining the foci of small portions of a lens by means of photographs is described. G. E. A.

1636. *Some New Cases of Interference and Refraction.* **R. W. Wood.** (Phil. Mag. 7. pp. 376–388, April, 1904. Communicated by the Physical Society, Jan. 22, 1904.)—A permanent film to show Newton's rings may be made by pressing a plate of mica against a pool of molten selenium on a glass plate, the whole being allowed to cool under pressure. On stripping off the mica, films of mica of variable thickness are left on the selenium, which show Newton's colours of great beauty, arranged in mosaics. A simple method of obtaining the colour of mixed plates is also given. After citing some examples of polarised fringes produced by the interference of two streams of light polarised at right angles, a remarkable case of interference is considered in which a thin film of collodion, deposited on a bright surface of silver, shows brilliant colours in reflected light. The film also scatters light complementary in colour to the directly reflected light. This is due to the fact that the film frills, the mesh being so small that it can only be detected with the highest powers of the microscope. [See also Abstract No. 741 (1904).] G. E. A.

1637. *Thermopile Measurements in the Ultra-violet Region.* **A. Pflüger.** (Phys. Zeitschr. 5. pp. 215–216, April 15, 1904. Ann. d. Physik, 13. 5. pp. 890–918, April, 1904. Physik. Institut der Univ., Bonn, Jan., 1904.)—In the first paper, in continuation [see Abstract No. 528 (1904)], the absorption of quartz, calcspar, rock salt, fluor spar, glycerine, and alcohol are measured, and the curve shows the per cent. incident radiation absorbed per 1 cm. thickness. Particulars of the number, size, and purity of the specimens are also given.



The second paper gives a full account of experiments mentioned in Abstracts Nos. 528, 1380, and 1412 (1904). The thermopile is used to examine the energy distribution in the spectra of a large number of metals. The absolute value of the energy in the spark was determined by comparison with that of a Hefner lamp taken as 2150 × 10^{-8} gm.-cal. sec.$^{-1}$ cm.$^{-2}$. The energy of the spark varied between 1/100 and 1/30 of this amount. The effects of spark-length and capacity on the energy distribution are also investigated.

G. E. A.

1638. *Doubly Refracting Substances formed from Isotropic Constituents.* **F. Braun.** (Phys. Zeitschr. 5. pp. 199–203, April 15, 1904.)—If, in an isotropic dielectric, particles of another isotropic substance with a greater dielectric constant are distributed, a substance is obtained which ought to exhibit, under certain conditions, the properties of double refraction. Such a substance is imitated by placing columns of bricks 6 × 12 × 24 cm. so as to form gratings with the bricks end on and with 6 cm. air spaces, and electric waves ($\lambda/2 = 17$, 24 and 34 cm.) are sent through it and received by a Righi resonator. The brick grating behaved towards the longest waves like a homogeneous doubly refracting mass; the results with the shorter waves were more complicated.

G. E. A.

1639. *Ultra-violet Rotary Dispersion.* **P. G. Nutting.** (Phys. Rev. 17. pp. 1–25, July, 1903.)—The spectrum lines of a spark passed between electrodes made of a zinc-aluminium alloy, and the interference bands caused by a double quartz wedge are photographed together, the rotation of the whole spectrum being thus obtained on a single plate. Curves are given of the rotary dispersion of cane sugar, camphor, limonene, pinene, lactose, maltose, tartaric acid, ammonium tartrate, potassium-sodium tartrate, and tartar emetic. The mechanism of rotation is then considered, and from theory a formula is deduced which gives a curve of rotation agreeing very closely with the observed curve even when only one term of the formula is taken. [See also Abstracts Nos. 38 and 285 (1902), and 1357 (1903).]

G. E. A.

1640. *Mutarotation of Milk-Sugar.* **C. S. Hudson.** (Zeitschr. Phys. Chem. 44. pp. 487–494, July 17, 1903.)—The mutarotation of milk-sugar is ascribed to the partial conversion of the sugar into a lactone, the change being accompanied by a decrease of rotatory power from + 85° to + 52·5°. The lactone can be isolated by evaporating at 100°, and shows a rotatory power changing from + 35° to 52·5°. This explanation is similar to that given by Emil Fischer in the case of glucose. The change of rotatory power of the hydrate or of the lactone is expressed by the equation—

$$\frac{1}{t}\lg.\frac{r_0-r}{r_t-r_\infty}=k+k',$$

where r_0, r_∞, and r_t are the initial and final rotatory powers, and that at time t_1, and k_1, k_2, represent the proportions of the two forms of the sugar that undergo change in unit time. When, however, the solution is kept saturated with the hydrate the equation becomes $\frac{1}{t}\lg.\frac{r_0-r_\infty}{r_t=r_\infty}=k'$, and the change of rotatory power depends only on the rate at which the hydrate is converted into lactone. At 10·2° the values found experimentally were—

$$k+k'=0{\cdot}00185,$$
$$k'=0{\cdot}00071,$$

whence— $k=0{\cdot}00114,$

and the proportion of lactone to hydrate in equilibrium $=\frac{114}{71}$. T. M. L.

1641. *Atomic Weight of Radium.* **W. M. Watts.** (Phil. Mag. 6. pp. 64–66, July, 1903.)—The author has previously shown that there appear to be two distinct kinds of connection between the spectra of allied elements and their atomic weights. In the case of zinc, cadmium, and mercury, and of gallium and iridium, the differences between the oscillation-frequencies of certain lines of the one element are to the differences between the oscillation frequencies of the other element as the squares of their atomic weights. [See Abstract No. 1182 (1903).] In applying this method some uncertainty exists as to the correspondence of the lines in the different spectra, but it is possible by accumulating evidence of this kind to obtain indications as to the probable atomic weight of radium from a comparison of its spectrum with those of mercury, barium, and calcium. By selecting appropriate lines it is possible to deduce for the atomic weight of radium the values 226·32, 226·42, 225·21, 225·32, 226·52, from the first type of relationship, and the values 225·05, 223·47, 220·36, 223·13, 227·39, and 224·63 from the second type of relationship. The mean of all these results is 224·89, the experimental value being 225. Whilst the spectroscopic evidence now adduced is not of a very certain character, it serves to throw doubt upon the calculations by which Runge and Precht deduced the value 258 for the atomic weight of radium, and indicates that the analytical value is not incapable of being reconciled with the spectroscopic evidence. T. M. L.

1642. *Unequal Absorption of Inverse Circular Vibrations on Passage through Incandescent Vapour in a Magnetic Field.* **O. M. Corbino.** (N. Cimento, 6. pp. 58–61, July and Aug., 1903.)—This is an extension of the work of Macaluso and Corbino on the appearances presented in the neighbourhood of the absorption bands produced by sodium vapour in a magnetic field. [See Abstracts Nos. 425 and 792 (1899).] With a slight modification of the arrangement the author studies the fringes produced by the rotatory polarisation due to a Fresnel's triprism. The flame is interposed between the triprism and the quarter-wave plate, and when the magnetic field is produced the spectrum in the neighbourhood of the absorption bands presents a chequered appearance, provided that the principal section of the quarter-wave plate is at an angle of 45° to that of the polarising nicol. Vertical bands are produced on account of the unequal velocities of the two circularly polarised rays in traversing the flame. The horizontal fringes are produced by the triprism. The author goes on to describe how the ellipticity in the vibration, which the flame produces, is measured by the displacement of the little squares on account of the rotation of the quarter-wave plate rather than by the displacement of the Babinet's fringes. S. G. S.

1643. *Analysis of Bright Spectrum Lines.* **J. Barnes.** (Astrophys. Journ. 19. pp. 190–211, April, 1904. Phil. Mag. 7. pp. 485–503, May, 1904.)—An interferometer method is employed for the study of the constitution of the many spectrum lines of various elements, which are known or suspected to be multiple. The apparatus was a modification of that used by Fabry and Perot, using the first plate more heavily silvered, whereby it was found that the bright bands were much clearer and measurement easier. Data are given for the results obtained with the green, yellow, and violet lines of mercury, and the effect of slight additions of foreign gases discussed; also the effect of various methods of excitation, spark (condensed or uncondensed) and arc. Other results with cadmium and hydrogen are given, with reproductions of photographs of the system of interference bands used. C.P.B.

1644. *Discontinuous Luminous Spectra from Solid Organic Bodies.* **E. Goldstein.** (Deutsch. Phys. Gesell., Verh. 6. Nos. 7–8, pp. 156–170, April 30, 1904.)—The author has examined the luminous spectra obtained from aromatic bodies exposed in the solid state to kathode rays, in the expectation that the spectra as thus obtained might be discontinuous even in cases where the substances when examined directly, do not exhibit absorption bands; the expectation, though not always justified, proved correct in the following instances: diphenyleneketone oxide (xanthone), diphenylenediketone (anthraquinone), anthracene, naphthalene and its nitrile, hydroxyl, bromo and methyl derivatives, quinoline and isoquinoline, diphenyl, dibenzyl, benzophenone, stilbene, azetnaphthalides. The substances were exposed to the kathode rays in tubes surrounded by a Dewar vacuum vessel containing liquid air. It appears that an increase in the number of rings in aromatic compounds corresponds with an increase in the tendency to give discontinuous spectra. Isomers related like the α and β derivatives of naphthalene show discontinuous spectra belonging to the same type but quite distinct. D. H. J.

1645. *Secondary Spectra.* **P. G. Nutting.** (Astrophys. Journ. 19. pp. 239–245, May, 1904.)—The paper deals with the spectra of gases in vacuum tubes, which are produced when capacity is introduced in parallel with the tube in a discharge circuit. The experiments were undertaken in an endeavour to separate, in the Mendeljeef periodic system, those elements which show multiple spectra from those which do not. Starting with the seventh group, it was found that chlorine, bromine, and iodine all gave multiple spectra. The same was found with oxygen, sulphur, selenium, and tellurium in the sixth group. In the fifth group nitrogen, phosphorus, and arsenic give multiple spectra, while bismuth does not. Tin and lead in the fourth group showed no change; in the third group aluminium, iridium, and thallium, and in the second, magnesium, zinc, cadmium, and mercury give only line spectra which are not essentially altered by the introduction of capacity in parallel. With the exception of hydrogen, the elements of the first group show only single spectra. C. P. B.

1646. *Radio-active Gas from Metallic Mercury.* **R. J. Strutt.** (Phil. Mag. 6. pp. 113-116, July, 1903.)—From experiments carried out the following conclusions are drawn: (1) A radio-active gas or emanation can be obtained by drawing air over hot copper, or by bubbling it through hot or cold mercury. (2) By repeated circulation through mercury very considerable activity can be obtained, of quite a different order from that of metals as ordinarily observed. (3) The mercury emanation deposits radio-active matter on the walls of the vessel containing it. This deposit remains after blowing out the gas, and possesses at first perhaps $\frac{1}{6}$th the activity of the latter. This induced activity falls to half value in 20 min. (4) The emanation itself decays in activity according to an exponential law, falling to half value in 3·18 days. J. J. S.

1647. *Action of* N-*rays.* **R. Blondlot.** (Comptes Rendus, 137. pp. 166-169, July 20, 1903.)—A bundle of *n*-rays sent out from an Auer burner was directed across screens of wood and aluminium and concentrated by a lens of quartz, being then caused to fall on a wire of platinum heated to dull redness by an electric current. When the wire was at one of the foci of the rays, increase in its brightness was caused. Similar effects were produced when a sheet of platinum at dull redness was placed at a focus of *n*-rays. No heating effect was detected when *n*-rays were caused to fall on a thermo-electric pile, nor does any rise of temperature occur when the rays fall on the platinum wire heated to redness, as was shown by tests for change of resistance of the platinum. The *n*-rays do not pass through platinum at ordinary temperatures, but they traverse incandescent platinum. J. J. S.

1648. *Penetrating Power and Storage of* N_1-*rays.* **J. Meyer.** (Comptes Rendus, 138. pp. 896-897, April 11, 1904.)—A closed tube of glass in the interior of which the pressure has been diminished is a powerful source of n_1-rays. The bulb of an incandescence lamp in which no current passes, a Geissler tube with hydrogen, and a Crookes tube also emit n_1-rays. Whilst n_1-rays from a Nernst lamp are stopped by a sheet of oxidised lead or by moist paper, those proceeding from the sources mentioned possess considerable penetrating power. They were found to traverse nearly all substances, but were stopped by a sheet of platinum and by opal glass. Aluminium stored up the rays and emitted them for more than 24 hours after being removed from the source. Ordinary glass also stores these rays, but retains the power of emitting them for only a short time. Salt water and a solution of hyposulphite of soda, after exposure to n_1-rays, also become sources and retain the property for a long time. The hand gains the property of emitting the rays after being held for some time near a source, the rays being probably stored by the perspiration. The n_1-rays emitted by the sources mentioned are refracted by prisms of glass, copper, and aluminium, and are diffracted by a grating. J. J. S.

1649. *Artificial Fluorescence of Living Tissues in Relation to Disease.* **W. J. Morton.** (Röntgen Ray, Archives, 8. pp. 194-197 April, 1904.)—The procedure involves two distinct factors—(1) The safe administration of solutions or mixtures capable of fluorescence or phosphorescence, and (2) the employment of an agency, externally or internally, capable of exciting fluorescence. The administration of the fluorescent materials may be by the mouth; by introduction in bulk within cavities, such as the stomach or intestines; by hypodermic injection into the circulation, or locally into a tumour; by cataphoresis; or by simple topical applications of washes and ointments. Of substances which may be used as medicines for this purpose, quinine and æsculin seem the most desirable, and of these, æsculin fluoresces in an alkaline solution, and its fluorescence is increased by the presence of sodium chloride. Æsculin passes through the organism unchanged, and can impart fluorescence to a solution as dilute as one part in a million parts. Other solutions which may be of use are fluorescin, resorcin, orcin, eosin, fraxin, uranin, rhodamin, and petroleum jelly. The agency for excitation is preferably radium or the Röntgen rays. The light from an arc lamp may be employed, or the static spark, or disruptive discharge when condensers are used, particularly if the electrodes are of iron. The method is capable of general application and is not restricted in its usefulness to any specific disease. The author is convinced that by artificial fluorescence he has secured results in the treatment of internal cancer, which he could not have obtained by ordinary radio-therapy. [See also Abstract No. 297 (1904).] H. W. P. Y.

1650. *Energy of Secondary Röntgen Radiation.* **C. G. Barkla.** (Phil. Mag. 7. pp. 543–560, May, 1904. Communicated by the Physical Society.)—The author draws the following conclusions from his experiments: (1) The character of secondary Röntgen radiation from gases differs slightly from that of the primary producing it. (2) The penetrating rays are transformed to a greater extent than the more absorbable rays. (3) The energy of secondary radiation from a given gas through which a primary beam of given intensity is passing is independent of the character of the primary radiation. (4) The energy of secondary radiation from gases and those light solids which are the source of a radiation differing little in character from the primary is proportional to the quantity of matter through which the primary beam of given intensity passes. (5) In the passage of Röntgen radiation through air at 0° C. and 76 cm. pressure, the diminution of intensity due to secondary radiation is of the order of magnitude 0·02 per cent. per cm. (This is a large fraction of the total loss of intensity due to all causes for fairly penetrating rays.) (6) From experimental results and theoretical calculations, taking the negative corpuscles as the sources of the radiation, the number of these corpuscles or electrons per c.cm. for air under normal conditions is of the order 10^{22}. (7) Quantitative results show that the secondary radiation from metals, though of different penetrative power, is of the same nature as the primary Röntgen radiation. (8) For the metals experimented upon the energy of secondary radiation is of the order of magnitude which agrees with the law found for gases, though the secondary radiation from metals differs considerably in character from the primary. [See also Abstract No. 1023 (1904).] J. J. S.

1651. *Radio-activity of Gas Liberated from Thermal Springs.* **P. Curie** and **A. Laborde.** (Comptes Rendus, 138. pp. 1150–1153, May 9, 1904.)—Quantitative tests were made of the radio-active gas liberated from a number of mineral springs. The most active were from Badgastein, in Austria, and from the Vosges district, and it is noteworthy that these waters contain none of the usual medicinal constituents of mineral waters, and possibly owe their physiological effect almost wholly to their radio-activity. The decay of activity is in accord with the statement frequently made that certain mineral waters lose their properties when stored. T. M. L.

1652. *Part Played by* N-*rays in Alterations of Visibility.* **J. Becquerel.** (Comptes Rendus, 138. pp. 1204–1206, May 16, 1904.)—The author considers that owing to the identity of the phenomena observed when *n*-rays act either on a luminous source or on the sense of vision, the way in which the rays act may be the same in both cases, the effect being to increase the sense of vision, and not the amount of light. This view led to an experiment in which the phosphorescent screen was placed on the far side of a parallel-sided glass flask filled with distilled water. The luminous cross of the screen ceased to be sensible to the action of the rays under these conditions, so that it was impossible to tell if *n*-rays were acting or not. With salt water in the flask, although the brightness of the screen was somewhat less, seen through the liquid layer, the variations of brightness were somewhat accentuated. This is interpreted as showing, in the author's opinion, that those rays, emitted by the screen, which are stopped by the distilled and pass through the saline water, accompany the luminous rays as far as the retina, on which they concentrate, giving rise to the increased local sensibility. In all these storage experiments there is a certain lagging behind of the effect. It is practically impossible to compare two neighbouring surfaces photometrically owing to the same portion of the retina being stimulated by the *n*-rays from one of them. L. H. W.

1653. *Radiation from Nerve Centres under Anæsthetics.* **J. Becquerel** and **A. Broca.** (Comptes Rendus, 138. pp. 1280–1282, May 24, 1904.)—It is known that vegetables, and sulphide of calcium or sand previously sunned, do not emit *n*-rays when under anæsthetics. During the setting up of anæsthesia the brain emits *n*-rays enormously; when anæsthesia deepens the *n*-rays disappear, and afterwards the n_1-rays appear (being with ether associated with danger to life, with chloroform a mark of deep narcosis). When the effect of the narcosis disappears, or in the case of the animal being killed by the anæsthetic, the *n*-rays reappear instead of the n_1-rays. The spinal cord presents analogous phenomena, but much less marked, the production of n_1-rays being feeble or absent. When *n*-rays disappear at the brain or begin to appear at the spinal cord the animal is in danger. The cessation of all radiation, for some minutes is a certain sign of death. Apparently the anæsthesia is due to the active excitation of inhibitory centres which inhibit sensation. A. D.

1654. *Simultaneous Emission of* N-*rays and* N_1-*rays.* **J. Becquerel.** (Comptes Rendus, 138. pp. 1332–1335, May 30, 1904.)—A small phosphorescent surface exposed to *n*-rays *looks* brighter because the light is accompanied by a secondary emission of *n*-rays which affect the retina and make it more sensitive. (A small flame acts in the same way.) The same phosphorescent surface looks dimmer when viewed tangentially; n_1-rays are being emitted tangentially from it, and impair the sensitiveness of the retina. A brick exposed to the sun or any other source of *n*-rays again emits *n*-rays normally and n_1-rays tangentially. Compressed bodies emit *n*-rays normally, stretched bodies emit n_1-rays; whence bodies under compression emit *n*-rays in one direction, and n_1-rays at right angles to these from the parts of the body which undergo dilatation. The wave-lengths measured in *n*-rays by Blondlot present simple numerical ratios between the different components of the whole radiation. The *n*-rays and the n_1-rays, once on their way, are optically similar but produce opposite effects, the former making bodies on which they fall radiate *n*-rays as if compressed, the latter making them radiate n_1-rays as if stretched. A. D.

1655. *Observations with a Blende Screen.* **H. Baumhauer.** (Phys. Zeitschr. 5. p. 289, June 1, 1904.)—The author points out how necessary it is for an investigator to know the conditions under which a screen will grow brighter independently of the presence of radio-active substances. A number of experiments in this connection are described, carried out chiefly to try and observe the effects of *n*-rays, which, however, the author did not succeed in doing. Thus the warm breath was found to cause the screen to brighten, though a blast of air produced no effect. Dipping in warm water made it glow intensely after taking it out of the water, though nearly the same effect was produced by spraying with cold water. Ether itself sprayed on had no effect, but as soon as it evaporated the screen glowed. The most remarkable effect observed was the following: After the screen had been sprayed with cold water it glowed at the wetted places, the glow becoming fainter. On breathing on the nearly dried screen, only those parts glowed which had not been wetted before, the former, wetted parts remaining dark. On the screen becoming quite dry and being held in the sunlight, the *whole* screen glowed again. The experiments are being continued. L. H. W.

1656. *Emission of* N-*rays by Crystalline Bodies.* **E. Bichat.** (Comptes Rendus, 138. pp. 1396–1397, June 6, 1904.)—If a piece of quartz be brought near a phosphorescent screen so that its axis is perpendicular to the screen, the quartz is found to emit *n*-rays. If the axis of the quartz is parallel to the screen, the quartz emits n_1-rays in the direction perpendicular to the axis. With Iceland spar the effects are the inverse of these. (To exclude outside influences a sheet of lead provided with a small hole is placed between the crystal and the screen.) This is attributed to the different elasticities the crystals present in the directions of the two axes. Quartz being a positive crystal and spar a negative one, according to this theory those crystals which are positive should behave like quartz and negative ones like spar. This is found to be the case for a number of minerals. Tourmaline being pyroelectric has its original properties, as a negative crystal, masked by the reverse phenomena when heated. A thin layer of strong common glue emits n_1-rays in a direction normal to the surface and *n*-rays at the side, at right angles to this. Bertin has already shown [Ann. Chim. Phys. 15. p. 129] that a series of thin plates of gelatine behaves like a uniaxial negative crystal. L. H. W.

1657. *Anæsthesia of Metals.* **J. Becquerel.** (Comptes Rendus, 138. pp. 1415–1418, June 6, 1904.)—The author has previously shown that in the same substance the molecules can give rise to *n*-rays or n_1-rays according as the body is in compression or extension. [See Abstract No. 1654 (1904).] He now investigates substances transparent to these rays to see if they do not themselves take up a vibratory movement transforming them into secondary sources, and if storage of the rays is not necessary for the propagation through the substance. Anæsthetics were used for this purpose, and experiments were carried out to verify the hypothesis that when the surface of a metal traversed by *n*- or n_1-rays is subjected to the action of chloroform or ether (the vapours of which are transparent to the rays), these rays can no longer penetrate or emerge from the treated face, at least without losing their property of behaving differently according to the mechanical effect which produced them. The results show that Al and Cu do lose their transparency when the surface receiving the rays, or that from which they emerge, is anæsthetised, quartz behaving similarly. Glass, wood, and cardboard, however, remain always transparent. To explain these results the *n*-rays are supposed to consist of two elements, one an undulatory one which propagates itself in Al like light does in glass, and another form of energy which is only slowly propagated and the transmission of which is stopped by the anæsthetised surface of metals. The author is investigating this point. L. H. W.

1658. *Contributions to the Study of the* N- *and* N_1-*rays.* **J. Becquerel.** (Comptes Rendus, 138. pp. 1486–1489, June 13, 1904.)—I. *Emission of* n- *and* n_1-*rays accompanying the contractions and dilations due to changes of temperature.*—In a former paper [see Abstract No. 1654 (1904)] the author has shown that when a body storing n_1-rays is heated, the radiation is increased before it disappears, and compared this phenomenon with that observed in heating a phosphorescent screen. Besides this, however, temperature variations give rise to a quite different effect due to changes in volumes ; thus heating (dilatation) is accompanied by emission of n_1-rays, cooling giving rise to *n*-rays. This was proved experimentally by means of a cone of copper, heated from the base (by plunging in hot water), when n_1-rays, appeared at the apex, the emission ceasing when the cone became heated throughout. Letting the cone cool, *n*-rays were emitted during the cooling until equilibrium as regards temperature was reached. The phenomenon was still more distinctly shown by plunging the cone, after being dipped in the boiling water, into cold water for an instant, before the heat had reached the apex. A screen then placed near the apex showed a series of oscillations in brightness giving way finally to *n*-rays only. II. *Simultaneous emission of* n- *and* n_1-*rays, by Prince Rupert's drops.*—These drops, which are a persistent source of *n*-rays, also emit n_1-rays in the direction of their length, the point in particular. III. *Action of alcohol vapour on sources of Blondlot rays and metals.*—The effect of anæsthetics in inhibiting Blondlot rays and rendering opaque metals which transmit them is known. Alcohol is found to have the same property as chloroform, but to take longer to produce the effect, yet lasting longer afterwards. From the experiments described the author thinks it possible that the reason why steel does not emit n_1-rays during anæsthetisation is that the n_1-rays emitted normally at the same time as the *n*-rays, are suppressed more quickly than the *n*-rays, a small proportion of alcohol not sufficing to suppress these latter. L. H. W.

1659. *Action of Sources of* N-*rays on Pure Water.* **J. Meyer.** (Comptes Rendus, 138. pp. 1491–1492, June 13, 1904.)—It is known that *n*-rays from tempered steel are stopped by moistened paper. To investigate whether the rays would traverse pure water in considerable thickness, a vessel 30 cm. diam. containing 8 cm. depth of water had a phosphorescent screen held just above the water. A file was placed 10 cm. below the vessel ; on bringing it nearer to the screen the phosphorescence diminished, thus showing that a source of *n*-rays (the file) on being brought near water, causes the water to emit n_1-rays. The same effect was observed even with a 1 mm. layer of water and also when the source of *n*-rays was completely immersed. Any other source of *n*-rays can be used such as a tube containing compressed air, the sun, an Auer burner, &c. A vase filled with water, with a frog or part of a green plant in it is also a source of n_1-rays. If to the water a few drops of chloroform are added, the effect due to the water disappears, the source of *n*-rays affecting the screen as though the water were not there. With sources of n_1-rays analogous effects are not obtained, for if the bulb of an incandescent lamp (source of n_1-rays) is brought near the screen the intensity diminishes, even through a thickness of 10 cm. of water, and the addition of chloroform to the water does not alter the effect in any way. L. H. W.

1660. *Action of a Magnetic Field on the* N- *and* N_1-*rays.* **J. Becquerel.** (Comptes Rendus, 138. pp. 1586–1589, June 20, 1904.)—The author has, from the results described in previous papers [see Abstract No. 1657 (1904)] concluded that there was more than one element present in the Blondlot rays, and, to see if there be not a material radiation besides, now tries the effect of a magnetic field on a beam of these rays. The method adopted is described. As a result it was found that the action of the *n*- or n_1-rays does not take place when the beam is caused to traverse a magnetic field (of about 130) in a direction normal to the lines of force, the ordinary effect being observed parallel to the field. The action of a radio-active substance on the phosphorescent screen was also tried, and the effect, with both radium bromide and uranium salt, found to be the same as under the influence of the *n*-rays. In looking at the flask of distilled water [see Abstract No. 1652 (1904)] the change of brightness was unobservable; with salt water, easily visible. The effect of a magnetic field was also examined in this case, and the increase of brightness readily observed when the magnet was not excited; but the action ceased as soon as the β-rays were deflected by the field. This interesting analogy between the effects produced by the *n*-rays and radio-active substances is being further investigated. L. H. W.

1661. *Influence of Colour of Luminous Sources on their Sensibility to* N-*rays.* **C. Gutton.** (Comptes Rendus, 138. pp. 1592–1593, June 20, 1904.)—The author describes experiments which seem to show that slightly luminous sources which emit violet and blue light are those which best lend themselves to *n*-ray observations. The different colours from the spectrum of a Nernst lamp were projected in the form of a spot on to a sheet of paper or ground-glass, precautions being taken to absorb the *n*-rays from the lamp. On bringing a source of *n*-rays up to the bright spot, it became more visible. With violet light maximum effects were obtained, with green light much smaller effects, and with yellow, orange, and red, no effect whatever. In the same way, on approaching the spot with the eye the effect of *n*-rays was to augment the sensibility of the eye, the influence of colour being as before. If in a dark room a part of the most refrangible region of the spectrum be projected, the action of the *n*-rays lengthens out the spectrum towards the ultra-violet, as would be expected from the preceding results. Finally, it is pointed out that the sensibility of the phosphorescent substances varies with their colour. Violet calcium sulphide is the most sensitive, sulphides of the alkaline earths and of zinc, giving a greenish phosphorescence, less so; while with the same sulphides giving an orange glow, no effect is produced by the *n*-rays. (This might explain the failure of de Hemptinne [see Abstract No. 1357 (1904)].) L. H. W.

REFERENCES.

1662. *Pressure of Radiation.* **T. H. Havelock.** (Phil. Mag. 6. pp. 157-165, July, 1903.)—A mathematical treatment of the pressure for (1) waves along a string, (2) electric waves. The main idea is that the pressure is due to absorption of energy. Larmor's treatment is followed. J. W. P.

1663. *Double Refraction in Glass with Statical Bending.* **W. König.** (Ann. d. Physik, 11. 4. pp. 842-866, June 22, 1903.)—The general object of the paper is to demonstrate the agreement between the observed optical behaviour of the glass and the elastic processes as given by theory, and the cases of the uniformly bent glass bar, a bar bent so as to have a point of inflection, and the general case in which both stretching and shearing take place are fully described. [See also Abstract No. 777 (1901).] G. E. A.

1664. *Optical Properties of Iodine.* **W. W. Coblentz.** (Phys. Rev. 17. pp. 51-59, July, 1903.)—A continuation of the previous work [see Abstract No. 1174 (1903)] with containing cells made of rock-salt laminæ. The absorption of the iodine solution from the ultra-violet to 16 μ in the infra-red is studied. Brown solutions are found to be quite transparent at the red end of the spectrum and to absorb heavily the violet. The violet solutions absorb heavily in the visible and transmit violet and all the infra-red beyond 1·2 μ. J. W. P.

1665. *Optical Resonance.* **J. Kossonogoff.** (Phys. Zeitschr. 4. pp. 518-520, July 1, 1903. Physik. Laboratorium d. k. Universität, Kiew.)—While pointing out that the experiments of Wood and himself were made independently, the writer acknowledges the priority of Wood, and, in specifying what is new in his own experiments, gives tables of measurements of the sizes of particles on butterflies' wings and of metallic and non-metallic particles. The diameters of the former are very nearly equal to a whole wave-length, those of the latter to a half wave-length. [See also Abstract No. 1348 (1903).] G. E. A.

1666. *Electric Dichroism of Liquid Mixtures.* **J. Chaudier.** (Comptes Rendus, 137. pp. 248-250, July 27, 1903.)—The author experiments on a variety of liquids in the electric field. Electric dichroism, like magnetic dichroism, can be characterised by a sign, and is dependent upon the two constituents of the mixture. Elliptical polarisation of the light results in the electric field; rectilinear in the magnetic. J. W. P.

1667. *Measurement of Dichroism of Crystals.* **G. Meslin.** (Comptes Rendus, 137. pp. 182-184, July 20, and pp. 246-248, July 27, 1903.)—In the first paper the effect of temperature on the sign of the dichroism is investigated for various liquids, and the law of indices is verified. In the second paper a description of apparatus for showing dichroism and of the characteristics of the phenomenon is given. [See also Abstracts Nos. 1381 and 1384 (1904).] J. W. P.

1668. *Application of Cornu's Spiral to the Diffraction Grating.* **A. L. Kimball.** (Phil. Mag. 6. pp. 30-33, July, 1903.)—The formula for the intensity of the light diffracted by a grating is obtained by means of a simple geometrical device. G. E. A.

1669. *Properties of Glass.* **W. Rosenhain.** (British Optical Journ. 2. pp. 262-268, July, 1903. Paper read before the Optical Society, June 15, 1903.)—The most important optical facts connected with the homogeneity, colour, hardness, and stability of glass are summarised, the methods for testing the above properties being also indicated. G. E. A.

1670. *Magnification of the Relief of Coins.* **C. Hoitsema.** (Zeitschr. Instrumentenk., Beib. 5. pp. 42–44, March 1, 1904.)—Two uprights on a long stand carry the coin and a large, vertical, smoked glass plate respectively, the construction being such that the plate moves ten times as fast as the coin when a handle is turned. A balanced pointer with arms in the ratio 1 to 10 has at one end a style moving over the coin, while at the other end another style traces the magnified motion on the smoked glass, an outline of the relief being thus obtained. G. E. A.

1671. *Speed Measurements with Camera Shutters.* **H. Lehmann.** (Zeitschr. Instrumentenk. 24. pp. 74–79, March, 1904. Communication from the optical workshops of C. A. Steinheil Söhne.)—The period of exposure of an instantaneous shutter is measured by means of a tuning-fork placed in the primary circuit of an induction coil. The secondary discharge is led to a rotating wheel on which is a spark-gap. Knowing the frequency of the tuning-fork, or measuring the speed of the wheel, the number of spark images photographed while the shutter is open gives the time of exposure, and may also be used to determine the frequency of the fork. A number of shutters by well-known makers are tested, and the times measured generally deviate considerably from the nominal exposures. G. E. A.

1672. *Variation of Double Refraction in Strained Glass with Wave-length.* (Third paper.) **L. N. G. Filon.** (Cambridge Phil. Soc., Proc. 12. pp. 313–336, April, 1904.)—A description of experiments on six Zeiss silicate-flint glasses forming a series for which both refractive index and mean dispersion appeared to vary regularly with the density. The cause of discrepancies in former results is investigated, and the effect of want of uniformity of stress through the glass is shown to be negligible. Results of three or four series of measurements for each glass, and the corresponding curves, are given, and Pockel's results are confirmed both as regards the effect of lead on artificial double refraction produced by stress for a given wave-length and the rate of change of C with wave-length. [See Abstracts Nos. 415 and 1009 (1903).] G. E. A.

1673. *Stereoscopic Images for Topographic Plans.* **A. Laussedat.** (Comptes Rendus, 138. pp. 1309–1312, May 30, 1904.)—The author comments on the use of exaggerated stereoscopy, obtained by juxtaposition of two photographs taken with a base several hundred times greater than the distance between our two eyes, about 6·5 cm. He refers to Pulfrich's stereocomparator and to similar instruments as in Abstract No. 1382 (1903). H. B.

1674. *Optical Activity of the Nucleic Acid of the Thymus Gland.* **A. Gamgee** and **W. Jones.** (Roy. Soc., Proc. 72. pp. 100–103, July 31, 1903.)—The rotation observed is influenced by the acidity of the solution, reaching a maximum and then decreasing; the addition of ammonia renders the solution optically inactive, though neutralisation with acid restores the original activity. The rotation of tritico-nucleic acid was also determined, a 4 per cent. solution giving $[\alpha]_D = +73°$. [See also Abstract No. 310 (1904).] L. H. W.

1675. *Physiological Action on Phosphorescence.* **A. Charpentier.** (Comptes Rendus, 138. pp. 919–920, April 11, 1904.)—Further experiments were made which point to the increase of phosphorescence in a phosphorescent screen opposite organs of the body having a physiological affinity for certain substances when these substances are interposed between the screen and the body. A similar reinforcement was found to occur when the active principles of an organ were interposed between the screen and a similar organ of the living subject. [See also Abstract No. 1361 (1904).] J. J. S.

1676. *Magnetic Rotation in Absorption Bands.* **O. M. Corbino.** (N. Cimento, 6. pp. 55–57, July and Aug., 1903.)—Gives photographs to justify, as against Voigt, his statement [see Abstract No. 1515 (1902)] that upon excitation of the field the pale fringes found within the absorption bands remain rectilinear and horizontal. There is no doubt that the rotation within the bands is positive. A. D.

1677. *Polarisation of Röntgen Rays.* **R. v. Lieben.** (Phys. Zeitschr. 4. pp. 469–472, May 15, 1903, and 5. pp. 72–74, Feb. 1, 1904.)—In the first paper the author experimentally shows that only a portion of the rays from a Röntgen-ray tube are polarised. In the second paper the author, having repeated the previous experiments with a modified apparatus, was unable to confirm the polarisation of the Röntgen rays. E. C. C. B.

1678. *Natural Rotatory Power of Certain Substances for* N-*rays.* **H. Bagard.** (Comptes Rendus, 138. pp. 686–688, March 14, 1904.)—The rotations, in cane sugar, terebenthine, and tartaric acid, of the eight different orders of *n*-rays mentioned in a previous paper [see Abstract No. 1014 (1904)] are given, *e.g.*, a layer of cane sugar (16·19 gm. per 100 c.cm. of solution) 1·6 mm. thick causes a rotation of 124° in a ray of the first order. Tartaric acid causes lævo-rotation of the *n*-rays. G. E. A.

1679. *Radium and Cancerous Throat.* **D. Walsh.** (Electrician, 52. p. 779, March 4, 1904. Abstracted from "Medical Press and Circular.")—The method of application is to enclose the bromide of radium in a small indiarubber capsule with a mica window, which is then fixed over the cancerous nodule with a strip of adhesive plaster for from 15 to 25 min. The action of the radium is strongest at the immediate point of contact, and lessens in power according to the distance from that point. A reaction occurs usually on the eighth day of treatment, accompanied by a slight rise of temperature. If the exposure be unduly prolonged the temperature may run up to 104° F., or even higher, and various symptoms of general disturbance of health may be manifested. The author suggests that the reaction may be due to the formation of an antitoxin. By means of a special contrivance he has succeeded in applying radium to the upper part of the pharynx. The author is confident that by means of radium it is possible to profoundly modify, and in some cases apparently to cure, surface rodent ulcers and epitheliomata. H. W. P. Y.

1680. *Blondlot's* N-*rays.* **J. G. McKendrick** and **W. Colquhoun.** (Nature, 69. p. 534, April 7, 1904. Physiological Laboratory, Glasgow University.)—Experiments were carried out on the Blondlot rays, but with uniformly negative results. Attention is called to Heinrich's observations, who found that the pupil dilates when examining an object situated in the field of indirect vision, and that it dilates still more during a short mental effort. He found also that on directing attention to an object in the field of indirect vision the ciliary muscle relaxes, thus diminishing the curvature of the crystalline lens, and this change is very marked during mental calculation. It is suggested that the mental condition of some observers in a state of expectancy may react on the intrinsic muscles of their eyes, and thus they may see what they think they should see. J. J. S.

1681. *Effect of Selenium Cells upon a Photographic Plate.* **G. Berndt.** (Phys. Zeitschr. 5. pp. 289–290, June 1, 1904. Physik. Lab. des Städt. Höh. Techn. Inst. Cöthen, March, 1904.)—The author attributes the effect which Chabot ascribes to a new emanation [see Abstract No. 1428 (1904)], to an action between the aluminium plate, used to cover the centre of the cell, and the selenium itself, as, on repeating the experiments of Chabot, in the same manner but with air spaces between the aluminium and the cell and the cell and the plate, no effect was observed, although one cell used was without current and one traversed by a current of the order 10^{-5}, and the exposure was 172 hours. L. H. W.

1682. *Apparatus for Simultaneous Demonstration of the Absorption of the α- and β-Rays of Radium.* **F. Paschen.** (Phys. Zeitschr. 5. pp. 160–161, March 15, 1904.)—The author shows how by a slight modification the apparatus used by Strutt [see Abstract No. 171 (1904)], for demonstrating the positive charge of radium enclosed in glass, can be arranged so that the negative charge of the penetrating β-rays can be seen at the same time. L. H. W.

1683. *Radio-activity of Mineral Waters.* **Blythswood.** (Röntgen Ray, Archives, 8. pp. 226–230, May, 1904. President's address at the Ordinary General Meeting of the Röntgen Society, March 3, 1904.)—An account of the recent experiments investigating the radio-activity of the mineral waters of Bath and Buxton. J. J. S.

1684. *Origin of the Energy Emitted by Radio-active Bodies.* **C. Bonacini.** (Accad. Lincei, Atti, 13. pp. 466–473, May 1, 1904.)—Experiments to ascertain whether the energy results from transformations in the atom or from the absorption of energy from an external source: results negative. Historical *résumé* of the subject: new lines of investigation suggested. A. D.

1685. *Whether Radio-active Emanations are Electrified.* **A. Battelli** and **F. Maccarrone.** (Accad. Lincei, Atti, 13. pp. 539–544, May 15, 1904.)—The authors conclude they are not, and that these emanations are neither the residues of atoms after shedding positive ions, nor are they these positive ions themselves. A. D.

1686. *Radio-activity Induced by Lightning.* **C. Chistoni.** (Accad. Lincei, Atti, 13. pp. 548–550, May 15, 1904.)—Case where a lightning-stroke affecting a building induced radio-activity in the fallen material, persistent for twenty days; radio-activity induced in the spark-gap of an induction coil lasts only half an hour. Similarly, lightning may sub-permanently magnetise soft iron. A. D.

1687. *Radio-activity of Russian Muds.* **I. Borgmann.** (Nature, 70. pp. 80–81, May 26, 1904.)—Certain muds in Russia have been shown to possess radio-activity. In the course of the experiments it was observed that a brass wire placed along the axis of a metal cylinder became electrified when disconnected from the earth, the enclosing cylinder being joined to earth. The sign of the electrification varied in different cases when the material of the enclosing cylinder was changed. J. J. S.

1688. *Physiological Effects of Radium.* **C.-J. Salomonsen** and **G. Dreyer.** (Comptes Rendus, 138. pp. 1543–1545, June 13, 1904.)—The authors have made experiments on the effect of radium on a species of Nassula and on encysting amœbæ. In the case of the former, after 15 to 24 hours, swelling occurred, and death after some days. The radiation arrested all development of cysts and caused death in 24 hours. On the amœbæ themselves the effect in 12 to 24 hours was to cause them to assume a circular condition, and the greater number died in 48 hours. The hæmolysing action of radium is found to be very pronounced in the case of the blood of certain animals—that of mice, for instance, being hæmolysed in one-third to one-fourth the time taken to hæmolyse human or rabbits' blood. [See also Abstract No. 770 (1904).] L. H. W.

HEAT.

1689. *Radiation Pressure.* **H. Pellat.** (Journ. de Physique, 2. pp. 484–490, July, 1903.)—Suppose a vacuous cylinder of infinitely short height, with base formed of a perfectly black body and closed by a movable piston on which acts an external pressure to balance the radiation pressure p, the temperature throughout being T and the radiation-energy per unit volume within the cylinder u. Addition of heat will change the volume by dv, doing external work pdv and altering the radiation-energy by $d.uv$ and the energy of the cylinder by a quantity of the form $\mathrm{K}d\mathrm{T}$, so that, if ϕ is the entropy, $\mathrm{T}\partial\phi/\partial\mathrm{T} = \mathrm{K} + v\,du/dt$, $\mathrm{T}\partial\phi/\partial v = p + u$, and therefore $u = \mathrm{T}dp/d\mathrm{T} - p$ or $p = \mathrm{T}\int u\mathrm{T}^{-2}d\mathrm{T}$. Hence $p = u/(n-1)$ if $u \propto \mathrm{T}^n$. Now if $(\mathrm{E}/2\pi)\cos\theta d\omega$ is the energy radiated at temperature T by a perfectly black body per unit surface per unit time within a cone of solid angle $d\omega$ whose axis is inclined at angle θ to the normal to the surface—so that E is the total radiation emitted per unit surface per unit time—and if V is the velocity of light, we easily show for the space between two infinitely close surfaces that $u = 2\mathrm{E}/\mathrm{V}$; whence, with Stefan's law $\mathrm{E} \propto \mathrm{T}^4$, we have $p = \frac{1}{3}u$. Maxwell's result $p' = u'$ is deduced in a more artificial way. R. E. B.

1690. *Heat-Conduction in Liquids.* **R. Weber.** (Ann. d. Physik, 11. 5. pp. 1047–1070, July 7, 1903.)—The liquids are contained in a vessel with glass sides and copper base, placed absolutely horizontal and standing upon ice, and are heated at the top by a metal vessel containing paraffin oil kept hot electrically. The conductivity was determined by measuring the electrical energy employed and the resulting differences of temperature of two layers about 1 cm. apart when the stationary state had been reached, a copper-constantan thermo-element being used, Full details respecting the precautions taken are given, and the following are the results obtained for the mean conductivity in c.g.s. units between about 35° and 12°: Water 0·00131, glycerine 0·000656, petroleum 0·000382, paraffin oil 0·000346, mercury 0·0197; for solid paraffin between 0° and 29·4°, 0·000372; between 0° and 34·4°, 0·000473. R. E. B.

1691. *Characteristic Equation.* **C. Dieterici.** (Ann. d. Physik, 12. 1. pp. 144–153, July 21, 1903.)—From discussion of the critical data for eleven substances the author finds that the value of $v(\partial p/\partial\mathrm{T})_v$ at the critical point is very approximately equal to 2R. As the value of RT/pv at the critical point is also equal to about 3·7, no expression of the form av^{-n} or $av^{-2}\exp(1 - \mathrm{T}/\mathrm{T}_c)$ is possible for the cohesion-pressure π, nor does the author's previously suggested characteristic $p(v-b) = \mathrm{RT}\exp(-\mathfrak{C}/v)$, where $\mathfrak{C}$ is a function of T, satisfy both conditions. These alone are not sufficient to determine the form of π; but as, with the usual form of the characteristic, π has further to satisfy the relation $\mathrm{T}\partial^2\pi/\partial\mathrm{T}^2 = -\partial^2\mathrm{E}/\partial v\partial\mathrm{T} \equiv -\partial k/\partial v$, where k is the isometric specific heat, observation of the latter may lead to a determination of π.

R. E. B.

1692. *Specific Heats of CO_2 and Isopentane.* **C. Dieterici.** (Ann. d. Physik, 12. 1. pp. 154–185, July 21, 1903.)—If mass M of a substance in two coexistent phases be confined in an invariable volume, the heat required to raise it from temperature T_0, at which m_0 is the mass in the higher phase, and λ'_0 the *internal* latent heat (the part of the heat of transformation which does not effect external work), to temperature T with corresponding m and λ', is obviously equal to the change of intrinsic energy, viz., $m\lambda' - m_0\lambda'_0 + M\sigma(T - T_0)$, where σ is the mean *internal* specific heat between T_0 and T of the saturated substance in the lower phase (*i.e.*, the part of its mean saturation specific heat which does not effect external work). From this consideration the values of σ for different values of T have been determined for CO_2 and isopentane by filling small thick-walled tubes with each liquid and its vapour in various proportions and dropping the tubes when heated into an ice-calorimeter. The actual internal specific heats S of the saturated liquid at T have then been deduced, and from these, together with Amagat's and Young's data, the values at T have been calculated of the internal specific heat S′ of the saturated vapour and the isometric specific heats k, k' of the liquid and vapour when just saturated, these being given by $S' = S + d\lambda'/dT$, $k = S - (T\partial_v p/\partial T - p)_{p=f}\, ds/dT$, $k = S' - (T\partial_v p'/\partial T - p')_{p'=f}\, ds'/dT$, where f is the saturation-pressure at T and s, s' the specific volumes at T of saturated liquid and vapour. It is not found that difficulty arises from the glass giving up very much more heat to the calorimeter than its contents, but the data are insufficient for exact calculation of the differential coefficients in the neighbourhood of the critical point. It is, however, concluded that k varies only slightly with the temperature, but considerably with the volume, having a maximum value for the critical volume. The special precautions necessary in the use of the calorimeter are fully recorded. R. E. B.

1693. *Specific Heat of Solutions of Naphthalene.* **C. Forch.** (Ann. d. Physik, 12. 1. pp. 202–210, July 21, 1903. Physik. Inst. d. Techn. Hochschule, Darmstadt.)—The solution was placed in a specially constructed calorimeter heated by a coiled resistance immersed in the liquid. The current, time, and rise of temperature were accurately measured. Elaborate precautions were made against loss of heat, corrections being made where necessary. The rise of temperature was 6–8° above the ordinary. The specific heats of chloroform, carbon bisulphide, toluene, benzene, and ethyl ether were determined first. Then for each solvent varying amounts of naphthalene were added and the specific heat of the solution determined. The specific heat was found to be fairly proportional to the concentration. The specific heat of naphthalene in solution was then found from these results. With ethyl ether as a solvent the specific heat of naphthalene was 0·427 cals. per gm., but the mean result for other solvents was 0·354 with a variation of ± 3·8 per cent. Previous observers have found 0·32 for solid, and 0·41 for melted naphthalene. [See also Abstract No. 588 (1903).] F. S.

1694. *Thermal Conductivity of Nitrogen Peroxide.* **C. Feliciani.** (N. Cimento, 7. pp. 18–35, Jan., 1904).—By the method of cooling, already adopted by Stefan, Warburg, Graetz, and others, the author has determined the thermal conductivity of nitrogen peroxide at different pressures and temperatures. The results show that (1) the conductivity is abnormal if compared with that of gases which do not dissociate, for temperatures up to 90°, and for pressures not less than 60 mm., it is greater than that of any non-dissociating gas hitherto studied; (2) it increases with the pressure; (3) it varies with the temperature in such a way that it may be stated that the coefficient of thermal conductivity is approximately proportional to the coefficient of dissociation. Naumann's data for the change in the amount of dissociation with change of temperature were used for this comparison. D. H. J.

1695. *Specific Heat and Specific Volume of Certain Alloys.* **H. E. Schmitz.** (Manchester Lit. and Phil. Soc., Mem. 48. 6. pp. 1–8, March, 1904).—The specific heat of the alloy Cu_3Sn was found to be 0·0785, the value calculated from a simple law of mixtures being 0·0787. The specific volume was found to be 0·1120, the calculated value being 0·1248, and the contraction in the formation of the compound 10·25 per cent. Alloys of aluminium with copper, zinc, and bismuth gave normal values for the specific heat, and in no case was there any large contraction in the formation of the alloy. T. M. L.

1696. *Latent Heat and Specific Heat of Metals at High Temperatures.* **F. Glaser.** (Metallurgie, 1. pp. 103–108, March 22, and pp. 121–128, April 8, 1904. From the Institut für Metallhüttenwesen u. Elektrometallurgie d. k. techn. Hochschule, Aachen.)—The method of mixtures is used. The calorimeter had a capacity of 40 litres. The heating chamber, as in Regnault's apparatus, was placed above it, and consisted of a resistance electrical furnace. In the central space a rod of gas carbon 2 mm. thick was heated by a current passing from a carbon block at the bottom to another carbon block at the top of the chamber. A uniform temperature was thus maintained, and the atmosphere within the chamber contained gas which would prevent oxidation of the metals used in the experiments. From observations at different temperatures the specific heat at the melting-point was found by extrapolation, and then, from the apparent specific heat of the molten substance, the latent heat was deduced. From the details of the observations the following table has been compiled:—

Metal.	Specific Heat at Melting-point.	Melting-point.	Latent Heat.
Lead	0·0324	326° C.	4·78
Zinc	0·1066	415	29·86
Aluminium	0·2745	657	76·80
Copper	0·1172	1084	41·63
Tin......................	0·0552	228	13·62

The furnace temperatures were measured by a le Chatelier thermo-element and a Siemens and Halske galvanometer. W. W. H. G.

1697. *Relation between the Viscosity of Nitrogen and the Temperature.* **A. Bestelmeyer.** (Ann. d. Physik, 13. 5. pp. 944–995, April, 1904. Extracted (with extensions) from the author's Inaugural Dissertation, Munich).—It is first shown that the law deduced by Sutherland [Phil. Mag. (5) 36. 507, 1893], $\frac{n_1}{n_2}=\left(\frac{\theta_1}{\theta_2}\right)^{\frac{1}{2}}\frac{1+C/\theta_2}{1+C/\theta_1}$, where n_1 and n_2 denote viscosities, θ_1, θ_2 the corresponding temperatures, and C is a constant, agrees well with the results of Holman and of Barus, *i.e.*, for the temperature-range 0–300°. The present research shows that Sutherland's formula gives a good representation of the relationship between viscosity and temperature in the case of nitrogen for the range $-190°$ to $+300°$. There is a deviation of about 2 per cent. at the temperature of liquid air, which probably shows that Sutherland's formula begins to break down at very low temperatures. The method of flow through capillary tubes was employed by the author. For details of the method reference must be made to the original paper. F. G. D.

1698. *Calorimetric Measurements with Liquid Oxygen and Liquid Nitrogen.* **H. Alt.** (Ann. d. Physik, 13. 5. pp. 1010–1027, April, 1904. Extract from the Münchener Inaugural-Dissertation).—The heat of vaporisation of liquid air is found to vary considerably with its composition. In the author's measurements of the heat of vaporisation of liquid oxygen and nitrogen, the liquid is heated electrically in a Dewar's vessel, and the quantity evaporated determined by weighing. The temperature is ascertained by means of a constantan-copper thermo-couple, and the pressure is also measured. The standard temperatures used for the thermo-couple are the boiling-points of oxygen and nitrogen (−182·9° and −196·17° respectively at 715 mm. pressure) and the freezing-point of nitrogen (−210·52°). The heat of vaporisation of oxygen changes rapidly with the temperature, but is not a linear function of it, the values obtained being:—

52·09 cals. at −183·0°
52·76 cals. at −188·0°
53·82 cals. at −193·0°
55·91 cals. at −198·0°
57·53 cals. at −200°
59·10 cals. at −201·5°

That of nitrogen is a linear function of the temperature, and is expressed by: $r = 1{\cdot}073 - 0{\cdot}2428\, t$. The specific heats of the two gases are obtained as follows: The external heat taken up per unit of time by the liquid under low pressure is calculated from the loss by evaporation. The liquid is suddenly brought to the atmospheric pressure, and heat imparted to it, by means of the electrically heated spiral, sufficient to give it the temperature corresponding with the new pressure. The external heat taken up is then measured under the altered conditions. From these data the specific heat of oxygen between −200° and −183° is found to be 0·347 ± 0·014, and that of nitrogen between −208° and −196°, 0·430 ± 0·008; the latter value agrees exactly with that arrived at by Dewar. T. H. P.

1699. *High Temperature Standards.* **J. A. Harker.** (Roy. Soc., Proc. 73. pp. 217–219, April 9, 1904. From the National Physical Laboratory. A continuation of work previously published by Chappuis and the author [see Abstract No. 637 (1900)].—In the present communication the temperatures range from 500° to 1,000°. The gas thermometer is compared with the platinum resistance thermometers, and with standard thermo-junctions of platinum—platino-rhodium. The results are (1) that two standard platinum resistance thermometers, when reduced by Callendar's formula, are up to 1,000° in close agreement with the pure nitrogen thermometer, using the recognised value for the expansion of the Berlin porcelain of which the bulbs are made; (2) that the platinum thermometers agree closely with a set of thermo-junctions representing the scale of the Reichsanstalt, which itself is based on measurement with a gas thermometer having a bulb of platinum-iridium. P. E. S.

1700. *Melting-point of Gold. Dilatation of Certain Gases Between* 0° *and* 1,000°. **A. Jacquerod** and **F. L. Perrot.** (Comptes Rendus, 138. pp. 1032–1034, April 25, 1904.)—The results of the author's experiments made with a constant-volume thermometer having a silica bulb are as follows:

The melting-point of gold, measured by a constant-volume nitrogen thermometer at an initial pressure of about 200 mm., is approximately 1,067°. The coefficients of expansion of nitrogen, air, oxygen, and carbonic oxide between 0° and 1,000° are extremely nearly equal; that of carbon dioxide between 0° and 1,000° is slightly less than between 0° and 100° and is appreciably greater than those of the above-named gases. T. H. P.

1701. *Calculation of the Volume-Correction in van der Waals' Equation.* **P. Ehrenfest.** (Akad. Wiss. Wien, Sitz. Ber. 112. 2a. pp. 1107–1115, July, 1903.)—In the course of his calculation of this volume-correction, Boltzmann, requiring an expression for the number of pairs of molecules at a given distance from each other, obtained it by assuming his theorem of the probability of configurations: the same expression is here found on the assumption of Maxwell's law of distribution of speeds. R. E. B.

1702. *On Isothermals and the Limiting Curve in the Neighbourhood of the Critical Point.* **J. E. Verschaffelt.** (Archives Néerlandaises, 9. pp. 125–130, 1904.)—The author has previously shown [see Abstract No. 1076 (1902)] that any isothermal may be represented by the empirical equation—

$$p = p' + \mu\left(\frac{v'-b}{v-b} - 1\right) + \alpha\left(\frac{v'-b}{v-b} - 1\right)^n,$$

where b is a constant and p', v', μ, α, and n are temperature-functions. It is now shown that by combining this empirical equation of six "constants" with Clerk-Maxwell's law, $p(v_2 - v_1) = \int_{v_1}^{v_2} p\,dv$, the phenomena relating to the two coexistent phases in the neighbourhood of the critical state can be quantitatively described with a fair degree of approximation. Considering the number of constants, *i.e.*, temperature-functions, employed, this is not surprising. F. G. D.

REFERENCES.

1703. *Specific Heat of Air.* **A. Kalähne.** (Ann. d. Physik, 11. 2. pp. 225–256, May, 1903. Physik. Inst. d. Univ. Heidelberg, Nov., 1902.)—Acoustic methods indicate that k does not vary below 450°; at 700° it has fallen off about 4 per thousand, and at 900° from 6 to 7 per thousand, to a value of 1·39 as against Stevens' figure of 1·34 at 950°. A. D.

1704. *Possible Duty of Fuel.* **K. Schreber.** (Phys. Zeitschr. 4. pp. 451–453, May 15, 1903.)—A detailed examination and criticism of a cyclical process suggested by Friedenthal. R. E. B.

1705. *Heat of a Change in Connection with Changes in Dielectric Constants and in Volumes.* **C. L. Speyers.** (Amer. Journ. Sci. 16. pp. 61–75, July, 1903.)—The author considers that the so-called loss of chemical energy involved in changes accompanied by the production of heat or light is in reality a physical change in the field surrounding the system, and due to the change in dielectric energy of the system, as measured by the dielectric constants of its components. Experiments on the heats of vaporisation of sulphur dioxide, ammonia and water, and on the heats of solution of various organic compounds in organic solvents, support this view, the dielectric constants being measured by Drude's method. W. H. St.

1706. *Magnetism and Thermal Conductivity of Iron.* **A. Lafay.** (Comptes Rendus, 136. pp. 1308–1310, June 2, 1903.)—The author refers to the effect discovered by Maggi in 1850, that the thermal conductivity of iron was altered by the action of magnetism, and to the experiments of Korda [see Abstract No. 1041 (1899)] which confirmed this assumption. Some experiments of the author's seemed also to bear out Maggi's statements, but on trying these in a vacuum the effect was absent. These experiments were repeated to see if there was some action, even if of exceedingly minute value, but no effect was noticeable, and the difference in conductivity in the two directions is considered to be below 5/1000. The author finally concludes that the Maggi effect was one of convection, and that in a powerful field it is probable that there is a slight decrease in thermal conductivity, the value of which is practically the same whatever the direction of the flux, magnetic or thermal. L. H. W.

1707. *Diminution of Potential for Spontaneous Changes in a Medium of Constant Temperature and Pressure.* **Ariès.** (Comptes Rendus, 137. pp. 46–47, July 6, 1903.) —By a short mathematical reasoning it is shown that if a system surrounded by a medium of constant pressure and temperature undergoes a spontaneous change owing to the suppression of anything hindering a change, then when equilibrium is established the potential of the system will be diminished. [See also Abstract No. 821 (1904).] F. S.

1708. *Superheated Vapour.* **A. Petot.** (Comptes Rendus, 137. pp. 173–175, July 20, 1903.)—An expression is given for the intrinsic energy of a superheated vapour, which is stated to be derived from Clausius' characteristic in its general form. From this the isometric specific heat *k* is obtained by differentiation, and examination of the resulting expression with the aid of Zeuner's tables shows *k* to increase with the temperature in the case of steam, and also its isopiestic specific heat near the points of condensation. R. E. B.

1709. *Sublimation Curves.* **A. Bouzat.** (Comptes Rendus, 137. pp. 175–176, July 20, 1903.)—Further considerations bearing out the statement enunciated in Abstract No. 1456 (1904). F. S.

1710. *Scientific Work of the Kälte-Versuch Station at Munich.* **C. Linde.** (Zeitschr. Vereines Deutsch. Ing. 47. pp. 1071–1076, July 25, 1903.)—This institution having ceased to exist as such, some of its work is here put on record. R. E. B.

1711. *A Continuous Steam Calorimeter.* **J. H. Hart.** (Phys. Rev. 18. pp. 263–274, April, 1904.)—If water be passed in a worm through a steam bath, and the condensed steam measured as well as the temperatures and mass of the water flowing, it is easy to find the latent heat of steam if the mean specific heat of the water be known. This method has been improved by the author until he finds he obtains results which compare favourably with those of the best of other methods known. Special precautions are taken to have the steam supply constant, and in other ways great care is taken to reduce experimental errors. The exact determination of the latent heat of steam by this method is now in progress. P. E. S.

1712. *Freezing-points of Solutions as Constant Temperatures.* **K. Prytz.** (Zeitschr. Phys. Chem. 47. pp. 729–732, April 11, 1904. Physik. Laboratorium des Polytechnikums, Kopenhagen.)—The method previously described by the author [see Abstract No. 1080 (1902)] may also be employed with benzene solutions. T. H. P.

1713. *Simple Proofs of the Phase-rule.* **A. Ponsot.** (Comptes Rendus, 138. pp. 690–693, March 14, 1904.)—An outline of three simple proofs of the phase-rule. A. F.

1714. *Behaviour of Radium Bromide at High Temperatures.* **J. Joly.** (Nature, 70. p. 31, May 12, 1904.)—From observations on minute specks of radium bromide heated upon the platinum ribbon of the meldometer its melting-point is found to be 728° C. At higher temperatures—up to 1,600°—there is every appearance of decomposition, a quiescent glass finally remaining on the hot platinum. This is insoluble in hot or cold water or HCl. J. J. S.

1715. *Solubility Curve in the Critical Temperature Region of Binary Mixtures.* **A. Smits.** (Konink. Akad. Wetensch. Amsterdam, Versl. 12. pp. 484–497, Feb. 25, 1904. Translated from Versl. van de gewone vergadering der Wis- en Natuurkundige Afdeeling, Jan. 30, 1904. Chem. Lab. Univ. Amsterdam, Dec., 1903.)—This is the conclusion of a former paper [see Abstract No. 331 (1904)], and contains several p-x sections. The author considers retrograde solidification and the continuity of solid and fluid phases. The system $AgNO_3 - H_2O$ is treated numerically. Notice is drawn to the dependance of true critical phenomena on the plaitpoint volume. H. H. F. H.

1716. *Thermometric Analysis of Solid Phases.* **E. S. Shepherd.** (Journ. Phys. Chem. 8. pp. 92–115, Feb., 1904.)—The author has tested the method of Bancroft [see Abstract No. 1915 (1902)] for determining the composition of the solid phase by means of temperature measurements, using the data of Heycock and Neville [Journ. Chem. Soc. 59. p. 936 (1891)] for the freezing-points of alloys of gold, cadmium, and tin for the purpose. Good agreement between the theoretical and observed values was found. A. F.

1717. *Note on Thermodynamic Surfaces.* **J. E. Trevor.** (Journ. Phys. Chem. 8. pp. 83–91, Feb., 1904.)—For a state (determined by the volume v and the entropy η) to be one of stable equilibrium, Gibbs showed that at the temperature θ and pressure p the relation $\delta e \geqq - p\delta v + \theta\delta\eta$ must hold for all variations of the energy e. From this it can be shown that in the region of stable equilibrium the surface $e = e\ (v, \eta)$ must be everywhere convex downwards. Gibbs has also shown that the thermodynamic properties can be represented by the surfaces $f = f\ (v, \theta)$, $g = g\ (p, \eta)$, $h = h\ (p, \theta)$, the functions f, g, and h being defined by the equations $f\ (v, \theta) = e - \theta\eta$, $g\ (p, \eta) = e + pv$, $h\ (p, \theta) = e + pv - \eta\theta$. The author seeks to determine the curvatures of those portions of these derivative surfaces that represent one-phase stable states and correspond to the convex portions of the primary energy surface. The original paper must be consulted for the reasoning and results. F. G. D.

1718. *More Exact Equation of State for Gases.* **J. B. Goebel.** (Zeitschr. Phys. Chem. 47. pp. 471–489, March 15, 1904.)—The equation $p = \frac{RT}{v - b} - \frac{a}{(v - a)^2}$, is proposed and compared with Amagat's results. In the case of CO_2, C_2H_4, and N_2O the value of b is found to be fairly constant, whereas in the cases of N_2 and O_2 it slowly decreases with increasing pressure. On the whole the above formula is found to be a fairly good approximation over certain ranges. F. G. D.

1719. *Thermal Effect of Phenyl Substitution.* **J. Schmidlin.** (Comptes Rendus, 136. pp. 1560–1562, June 22, 1903.)—From a study of the thermal changes accompanying the introduction of the phenyl group into the phenylmethanes and their carbinols and chlorides, the author finds that the thermal effect is not constant but varies with the character of the mother compound. Increasing resistance is offered to the introduction of the negative phenyl group by compounds of increasingly negative character. On the other hand, phenyl groups offer greater resistance to the entrance of an intensely negative element than to one less so. The quantity of heat evolved, either on the formation of the carbinols by fixation of oxygen or by the replacement of hydrogen by chlorine, becomes less as the number of phenyl groups in the molecule increases. T. H. P.

SOUND.

1720. *Velocity of Sound in very Narrow Tubes.* **F. A. Schulze.** (Ann. d. Physik, 13. 5. pp. 1060–1066, April, 1904. Also Sitzungsber. d. Marburger Naturwissensch. Gesell. p. 59, 1903.)—Kirchoff's formula $v = V\left(1 - \frac{\gamma}{d\sqrt{\pi n}}\right)$ is employed, and the measurements are made by the Quincke double tube interference apparatus. Tubes of glass, brass, and caoutchouc are used. The diameters range from 0·99 to 1·51 mm. Frequencies of 512 and 384 are employed, and v (velocity in the tube) is found to range from 195 m. per sec. to 290 m. per sec. for the high frequency. The influence of the nature of the tube is marked. γ is found to range from 0·0075 to 0·025 according to diameter and nature of tube. J. W. P.

REFERENCES.

1721. *Intermittence Tones.* **K. L. Schaefer** and **O. Abraham.** (Ann. d. Physik, 13. 5. pp. 996–1009, April, 1904. Berlin Univ. Psychol. Inst.)—It is said that when sound of any pitch is shut off, say, 64 times per sec., a sound is also heard whose frequency is 64. Is this a physical or a physiological effect? But experiment by means of a telephone shows that this is not the fact; the primary sound disappears and the intermittence tone is not heard, and instead we have a more or less complicated noise, apparently made up of difference-tones and overtones, audible in a resonator, and shown by oscillating flames. The cause appears to be that the telephone disc, subjected to interrupted vibration, takes up a new form of vibration involving these difference-tones and harmonics. No other method of producing the alleged subjective intermittence tones is beyond some analogous physical explanation, independent of the internal ear. A. D.

1722. *Hearing.* **Marage.** (Comptes Rendus, 138. pp. 482–485, Feb. 22, 1904. Soc. Franç. Phys., Séances, 1. pp. 46–57, 1904.)—Study of cases of sclerous otitis and of deaf mutes, to ascertain whether different regions of the internal ear are set in vibration by sounds of different pitch (v. Helmholtz). In pathological conditions the chain of bones seems to transmit vibrations, conserving their form but modifying their pitch and intensity; and it appears there are different parts of the internal ear which are affected by vibrations of different form (timbre). A. D.

1723. *The Transverse Figures in the Kundt Tube.* **F. A. Schulze.** (Ann. d. Physik, 13. 5. pp. 1067–1072, April, 1904. Physik. Institut, Marburg.)—The figures are employed to measure the periods of the tones of a Galton pipe, and the transverse and regular arrangement is explained by a supposition of variable sound intensity perpendicular to the tube axis. Results of Konig and Müller are considered. J. W. P.

1724. *Theory of the Acoustic Field.* **Charbonnier.** (Comptes Rendus, 137. pp. 171–173, July 20, 1903.)—A mathematical consideration of the relations of a moving solid to the surrounding atmosphere. The theory explains the features observed in photographs of projectiles. J. W. P.

ELECTRICITY AND MAGNETISM.

THEORY, ELECTROSTATICS, AND ATMOSPHERIC ELECTRICITY.

1725. *Deflection of Positive Rays in an Electromagnetic Field.* **J. Stark.** (Phys. Zeitschr. 4. pp. 583–586, Aug. 1, 1903.)—This paper deals with the various explanations of the experiments by W. Wien, which showed that positive rays exhibit a variable deflection. After reviewing previous explanations, a new hypothesis is advanced as follows: Suppose, first, that the charge of the negative electron is constant and of value $3{\cdot}1 \times 10^{-10}$ electrostatic units. Let the charge of the positive ions be the same or vary discontinuously as the natural whole numbers, so as to be a multiple of the above elementary quantity. Secondly, suppose that the positive rays on entering the deflecting electromagnetic field and the gas there existing are all of identical character, *i.e.*, possess equal masses, charges, and velocities. Thirdly, make the new assumption that just as positive and negatively charged particles, if they possess speed enough, so also neutral molecules or atoms under like circumstances may assume the ray-like character. Consequently a gas throughout a certain region may move rectilinearly and by bombarding a certain body make it luminous. The condition of a sufficiently high velocity is easily obtained in the case of the ions by means of a potential gradient, but this does not avail for the neutral particles. But these may attain the necessary high velocity in either of the two following ways: First, a positive ray particle may give its velocity to a neutral one by collision, being itself brought to rest. Secondly, a positive ray particle may, by receiving a negative electron, be changed into a neutral particle and thenceforward be a neutral ray tangential to the curved path the particle was previously describing. In this case the velocity of the positive ray particle would hardly be changed as the mass of the acquired negative particle is so much smaller. Thus, however the transformation of the positive rays into neutral rays occurs, whether by impact or neutralisation, the further angular deflection of the rays at that instant ceases. But, since the neutralisation may be effected at various places, the rays are spread out into a bundle exhibiting a variable deflection, or form a spectrum as observed by W. Wien. [See also Abstract No. 1728 (1904).] E. H. B.

1726. *Connection Between the Medium and the Ponderomotive Action between Magnets and Currents Induced by Magnets.* **B. Weinberg.** (Jurn. Russ. Fisik. Chimičesk. Obščestva, 36. No. 4b. pp. 99–105, 1904.)—The author shows the Laplace law to be closely connected with the law of Neumann-Faraday on the induction of currents, the latter being thus enunciated: The difference of magnetic potential in two points of space (the magneto-motive force) is equal to the rate of cutting of the lines of electric force by a line connecting the two points in question. As, according to the theory of effect at a distance, the number of lines of magnetic and electric force remains constant on the (infinite) medium being altered; it follows that the ponderomotive action between a magnet and a current cannot depend on the dielectric constant of the medium, as the induction of currents by magnets cannot depend on its magnetic permeability. [See also Abstract No. 345 (1904).] A. G.

1727. *Electrodynamics of Moving Bodies.* **W. Wien.** (Ann. d. Physik 13. 4. pp. 641–662, and pp. 663–668, March, 1904. Physikalisches Institut, Würzburg, Nov., 1903, and Jan., 1904.)—After an inductory survey of the theories of Maxwell, Lorentz, Hertz, and Cohn and the experiments of Michelson and Morley, the main body of these papers is divided into three parts. These deal with—(1) The relation of Lorentz's equations to those for bodies at rest; (2) the velocity of propagation of disturbances, and (3) the influence of motion on radiation. The whole is analytical and difficult to condense with advantage, but the following important results may be noted: (1) That velocities exceeding that of light require an infinite work expenditure. (2) The great radiation by transverse motions of electrons shows that when approaching the speed of light an electron would be no longer deflectable.

E. H. B.

1728. *Positive Electrons and the Existence of Higher Atomic Weights.* **W. Wien.** (Ann. d. Physik, 13. 4. pp. 669–677, March, 1904. Physik. Institut, Würzburg, Dec., 1903.)—The author's previous experiments showed that positive electrons exhibit deflections which instead of being constant like those of the negative rays were continuously variable. From this it was concluded that the specific charge is variable, *i.e.,* that either the conception of greater molecular complexities must be admitted, or else the possibility of further subdivision of the elementary electric charge accepted. To these two possible explanations, J. Stark has added a third [see Abstract No. 1725 (1904)], viz., that there are present only positive electrons with one elementary charge and molecules which are formed from the positive electrons by their union with negative electrons. This hypothesis, because of its great simplicity, is accordingly put to various experimental tests. Electrodes are placed in various positions to catch the rays, and precautions taken to avoid spurious effects from diffusion. The tubes are experimented upon with air, hydrogen, oxygen, and carbon-dioxide. But the author is driven to the conclusion that the hypothesis of Stark is untenable, being distinctly at variance with the facts. Taking the view of higher atomic weights, he finds that in one case a value of $e/m = 15{\cdot}5$, would correspond with the observed phenomena, *i.e.,* a molecular weight 650 times that of hydrogen. Finally, the author puts forward another hypothesis, viz., that the positive particles are neutralised, but then in their path split again. But he has not yet experimental evidence to prove this. [See also Abstracts Nos. 466 and 652 (1903), 2251 (1902), 822 (1901), and 1147 (1198).] E. H. B.

1729. *Internal Field of Electrons.* **E. Kohl.** (Ann. d. Physik, 13. 4. pp. 770–790, March, 1904.)—A highly mathematical paper difficult to abbreviate with advantage. It treats the internal field of electrons on the basis of the usual electromagnetic equations, and enunciates certain relations between the internal and external fields. [See also Abstracts Nos. 1416 (1903), and 591 (1904).]

E. H. B.

1730. *On the Theory of Plane Condensers.* **N. Boulgakow.** (Jurn. Russ. Fisik. Chimičesk. Obščestva, 36. No. 4b. pp. 71–93, 1904.)—In a former paper [see Abstract No. 838 (1903)], the author has given an accurate expression for the capacity of a condenser the armatures of which have some plane portions; the latter are bounded by potential level surfaces, depending on electric masses which are distributed on two surfaces of the form of shallow, coaxial ellipsoids of revolution. Those level surfaces, however, show some protuberances in the neighbourhood of their edges. In the present paper the author shows that these protuberances will vanish in the case of $c \leqq \sqrt{\frac{3}{4}}\,d$, where c is the linear eccentricity of the ellipsoid and d the distance of their centres. The author establishes the formula giving the flux in the interior of the hyperboloid, the meridional sections of which are the lines of force of the electrified ellipsoids. Finally, a formula for the charge of any given portion of the surface of the armature is given. A. G.

1731. *Electric Origin of Rigidity and Consequences.* **W. Sutherland.** (Phil. Mag. 7. pp. 417–444, May, 1904.)—This paper is one of a series in which the author applies the hypothesis of electrical doublets to account for the known properties of matter. At absolute zero, rigidity is considered to be a purely electrostatic phenomenon as follows: Let the electric doublets in a metal be so arranged that their charges form alternate plane laminæ of positive and negative electricity of surface density σ. Then the average electric force between the laminæ is $4\pi\sigma/\mathrm{K}$, and (according to Maxwell's view) the energy in unit volume of the dielectric is $\frac{1}{2}\sigma \,.\, 4\pi\sigma/\mathrm{K}$. To make the laminar distribution correspond with the charges of the electric doublet the value of σ must be $e/(m/\rho)^{\frac{2}{3}}$, where e is the charge and m is the mass of a molecule, ρ being the density of the substance. Moreover, to give the properties of a homogeneous substance, use three laminar distributions at right angles to one another, such that each would give one-third of the energy due to the doublets in the actual body they represent. Thus, then, the electrostatic energy per unit volume due to the components of the doublets in any one direction can be written—

$$\frac{2\pi}{3\mathrm{K}} \cdot \frac{e^2(m/\rho)^{\frac{2}{3}}}{(m/\rho)^2} = \frac{2.1}{\mathrm{K}} \frac{e^2(m/\rho)^{\frac{2}{3}}}{(m/\rho)^2} \quad \ldots\ldots\ldots\ldots\ldots\ldots(1).$$

By another train of reasoning, based partly on previous papers, t is shown that the rigidity N of a metal at absolute zero is given by—

$$\mathrm{N} = \frac{2.3}{\mathrm{K}} \frac{e^2 s^2}{(m/\rho)^2} \quad \ldots\ldots\ldots\ldots\ldots\ldots(2),$$

where s is the distance apart of the positive and negative electrons forming the electric doublets which cause molecular attraction. A comparison of the two equations shows that they are identical if $s = (m/\rho)^{\frac{1}{3}}$, by which it appears that in monatomic molecules of metals the two electrons are on the surface of an atom at the ends of a diameter. It is then shown that the rigidity of a pair of electrons is their electrostatic energy. It is next supposed that as the temperature is raised to θ, a part of the original electrostatic energy is converted into electrokinetic energy. The rigidity n at temperature θ of a metal whose melting-point is T is then put in the form—

$$\frac{n}{\mathrm{N}} = 1 - \left(\frac{\theta}{\mathrm{T}}\right)^2 \quad \ldots\ldots\ldots\ldots\ldots\ldots(3).$$

The theories of electric and thermal conductivities of metals are then discussed on the hypothesis of the electric-gyrostatic properties of molecules. Finally, a theory of the structure of the ether is developed which gives a value of the speed of light 1·25 times the true value. The corresponding values for the density and rigidity of the ether are respectively, $\rho = 5 \times 10^9$, and $\mathrm{N} = 8 \times 10^{30}$. These, it is pointed out, must be taken as upper limits, and result from an ether built up of electrons in contact. It is contended that they cannot be dismissed as absurd merely because of their magnitude. Other lines of inquiry must furnish data for decisive determinations. [See also Abstract No. 818 (1903).] E. H. B.

1732. *Electrostatic Deflection of the Rutherford Rays.* **T. des Coudres.** (Phys. Zeitschr. 4. pp. 483–485, June 1, 1903. Physik. Institut, Würzburg.)—Rutherford inferred from measurements of the electrical conductivity of air under different conditions, that the α-rays were capable of deflection in both a magnetic and an electrical field. The direct demonstration of this deflectibility in a *magnetic* field has since been given by Becquerel. [See Abstract No. 1190 (1903).] The author confirms Becquerel's work, and also, by direct experiments, shows the deflection of the Rutherford rays in an *electrostatic* field between two condenser plates with a difference of potential of 110 volts or more. [See also Abstract No. 1352 (1904).] D. H. J.

1733. *The Important Part which Electrical Conductivity plays in Electrostatic Phenomena.* **W. v. Nicolajew.** (Phys. Zeitschr. 4. pp. 546–549, July 15, 1903. 5. pp. 169–174, April 1, 1904. Physikal. Lab. d. Akademie d. Wissenschaften zu St. Petersburg. From the French.)—In a previous paper the author has shown that the force between two conductors carrying current in opposite directions may be an attraction or a repulsion, according to the magnitude of the current and the distance apart of the conductors [see Abstract No. 1342 (1902)]. In this paper the author obtains the expression—

$$T_{1(N)} - T_{2(N)} = \left(\frac{D_1}{\lambda^2} - \frac{D_2}{\lambda_2^2}\right)(\rho_1 \cos \delta_1)^2 \frac{\pi}{8}$$

for the outward force acting across unit area of boundary of a medium, due to the normal component of the electrical field, where D_1 and D_2 are the dielectric constants of the media on the two sides of the boundary, and λ_1 and λ_2 their specific conductivities. The force due to the tangential component is $T_{1(T)} - T_{2(T)} = (D_1 - D_2)(F_{1(T)})^2 \frac{\pi}{8}$ and is independent of the conductivities. From the first expression this force is directed from medium (1) to medium (2) when $\frac{\lambda_2}{\lambda_1} < \sqrt{\frac{D_2}{D_1}}$, and hence when this condition is fulfilled, the medium (2) is repelled by a charged body situated in medium (1), although according to the purely electrostatic theory there should always be an attraction when $D_2 > D_1$. Thus if the medium (1) is air ($D_1 = 1$), and the medium (2) is paraffin ($D_2 = 2$), the paraffin will be repelled by a charged body situated in air if $\lambda_1 > 0{\cdot}714\lambda_2$. Again, if $D_1 = D_2$, as for paraffin and naphtha the electrostatic effect is zero, so that if the conductivity of naphtha is greater than that of paraffin there should be a repulsion. This effect was observed, and in the case of a stearin candle immersed in kerosine the effect is still greater. Other experiments are described, in which the same effect is exhibited, showing that these substances are conducting, and only differ from ordinary electrical conductors in the time required for the field to produce a conduction effect. It is pointed out that in all the usual electrostatic experiments, air is one of the two media concerned, and that this is always a better insulator and has smaller dielectric constant than the second medium. If, however, the air is ionised by means of radium, the usual effect is reversed. It was found that a piece of paraffin is repelled by a charged conductor when the air between them is ionised in this way. The author concludes that there is no such thing as real insulation, and that conduction plays a part in all the so-called electrostatic phenomena. S. G. S.

1734. *Electrical Field in the Interior of an Insulator which is Immersed in an Electrolyte; and the Continuous Rotation of the Insulator.* **W. v. Nicolajew.** (Phys. Zeitschr. 4. pp. 709–713, Oct. 15, 1903; 5. pp. 203–205, April 15, 1904. Physikal. Institut an der Universität zu St. Petersburg. From the French.)—The glass vessel AC contains nitrobenzol, and in this floats the second vessel E. The latter is kept in position by a thread attached to B, and in it is suspended a metal plate M. The terminals PQ are connected with a transformer giving a p.d. of 15,000 volts. It is then found that M sets along the line joining P and Q. That this is not due to the electrical field produced by P and Q is shown by placing the terminals outside the vessel AB, so that there is no conduction current, M being then undisturbed. The nitrobenzol thus forms a perfect shield so far as direct electrostatic effect is concerned. If, instead of fixing the vessel E and allowing M to rotate, the latter is held in a position inclined to the line joining PQ, as shown in the right-hand diagram, the vessel is found to rotate continuously. The rotation can be stopped and set up in the reverse direction by making M slope in the opposite manner. The author concludes that there is an electrical field in the interior of the insulator, which in this case is the air in the vessel E, when this is surrounded by an electrolyte through which a current is flowing. S. G. S.

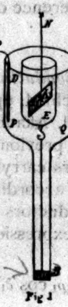


Fig 1

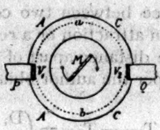


Fig 2

DISCHARGE AND OSCILLATIONS.

1735. *On the Law of Recombination of Ions.* **P. Langevin.** (Comptes Rendus, 137. pp. 177–179, July 20, 1903.)—The mean displacement of the ions in an electric field X will occur with the velocity k_1X for the one kind of ion, and k_2X for the other, where k_1 and k_2 are the mobilities of the ions of opposite sign. If p and n are the volume-densities of the charges carried by the positive and negative ions, combination follows the law $\frac{dp}{dt}=\frac{dn}{dt}=-\alpha pn$, where α is the coefficient of recombination independent of the field. The author has shown previously [see Abstracts Nos. 1412 (1902), and 1708, 1709 (1903)] that the ratio of the number of recombinations to the number of collisions is represented by $\varepsilon = \frac{\alpha}{4\pi (k_1 + k_2)}$. On pursuing the matter from the point of view of the kinetic theory, the author finds that the ε is proportional to the square of the pressure, for small pressures. This is supported by experiment. The author also shows that the value of ε calculated from the data of molecular size, charge on an ion and laws of electrolysis, agrees with the experimental value. Further, it follows that α, the coefficient of recombination, is, at low pressures, proportional to the pressure. A. F.

1736. *Kathodic Fall of Potential as Function of Temperature, Current, and Gas Pressure.* **J. Stark.** (Ann. d. Physik, 12. 1. pp. 1–30, July 21, 1903.)—The paper is in three sections, the first containing a review of the subject, and the author's method of attacking it. The second part deals with the influence of temperature on the kathodic portion of the glow discharge. The effect of temperature on the pressure p, and the area f of the kathode over which the discharge is taking place is considered, with special reference to the previously given equation for the kathodic fall of the potential K :—

$$K = K_n + \frac{k'}{pf^{\frac{1}{2}}}(i - x' . p . f)^{\frac{1}{2}}.$$

K is the whole kathodic p.d., and K_n the normal kathodic p.d. The conclusion is reached that although p and f are both functions of the temperature of the kathode, the kathodic p.d. for constant molecular concentration of the gas is independent of the temperature. The equation given above becomes—

$$K = K_n + \frac{kT}{pf^{\frac{1}{2}}}\left(i - \frac{x . p . f}{T}\right)^{\frac{1}{2}} \text{..........................} (a)$$

In the third section of the paper the variation of kathodic p.d. with current and pressure is studied. It is shown that for constant current, the relation between gas pressure and the excess of the observed kathodic p.d. over the normal kathodic fall is a hyperbolic one, *i.e.*,

$$\frac{(K - K_n) . p}{i^{\frac{1}{2}}} = \text{const.}$$

This is in accordance with equation (a), when i is great compared with $\frac{xpf}{T}$, that is, when K is considerably greater than the normal p.d., K_n. The author concludes that for dry air, free from mercury vapour, the relation (a) holds good, and that it is probable that for any gas whatever the equation becomes—

$$K = K_n + \frac{kT^m}{p^m f^q}\left(i - \frac{x . p^n f}{T_n}\right)^q.$$

where K_n, k, x, m, n, and q are quantities to be determined for each gas.

S. G. S.

1737. *The Singing Arc and its Study by Stroboscopic Methods.* **O. M. Corbino.** (Atti dell' Assoc. Elettr. Ital. 7. pp. 369–378, July–Aug., 1903. Paper read before the meeting at Palermo, May 21, 1903.)—The current in the shunt circuit to the electric arc, as used by Duddell, is evidently not sinusoidal, which may be shown by employing a Braun tube. Hence the formula $T = 2\pi\sqrt{LC}$ is not applicable. The differential equation for the current is obtained; it is $L\frac{d^2I}{dt^2} + \left(r - \frac{b}{(J-I)^2}\right)\frac{dI}{dt} + \frac{I}{C} = 0$, where J is the current in the battery circuit and I that in the shunt circuit. The solution of this is evidently not a sine function. The author then mentions the work of Ascoli and Manzetti, in which they determine the frequency of the current by illuminating a rotating disc by means of the arc in question. The disc is divided into white and black sectors, and when the sectors appear stationary, the number passing any fixed point in one second is the frequency of the current in the arc. They found that as the speed of the disc is diminished, a point is reached when the sectors again appear stationary, but the number seen is a multiple of the actual number of sectors on the disc. They therefore concluded that a periodic current of low frequency exists in the arc, in addition to that given approximately by the equation $T = 2\pi\sqrt{LC}$. The author goes on to show analytically that when the illumination undergoes a sine variation in intensity, the above effect would be observed without requiring the presence of a superimposed vibration of low frequency. He also shows that the effect is only observed when the period of intermittence of the illumination is $\frac{1}{m}$ of the period of substitution of one white sector for another, m being an even whole number, and the number of sectors seen is m times the real number on the disc. If m is odd the disc appears uniformly illuminated. An experiment was made to see whether an abruptly intermittent illumination would produce the same effect. It was found that in this case the phenomenon was very clearly exhibited. S. G. S.

1738. *Electrodeless Discharge.* **E. Lecher.** (Phys. Zeitschr. 4. pp. 811–814, Nov. 1, 1903. Also Akad. Wiss. Wien, Sitz. Ber. 112. 2a. pp. 994–1008, July, 1903.)—The coil of wire around the bulb possesses considerable impedance for the rapidly alternating currents sent through it. The different parts of the wire are therefore at very different potentials, and the view is advanced that in nearly every case the discharge is an electrostatic effect arising from this great potential difference. **J. Härdén.** (Phys. Zeitschr. 5. pp. 74–75, Feb. 1, 1904. Wissenschaftl. Lab. der Gen. El. Co. Schenectady, U.S.A., Nov. 17, 1903.)—The author supports Lecher's conclusion that the discharge is electrostatic. R. S. W.

1739. *Neugschwender's Experiment.* **C. Fornari.** (N. Cimento, 7. pp. 165–170, March, 1904.)—A microscopical examination into the way in which metal is carried across a fine gap in a circuit when moisture is present, and the effect of Hertzian waves upon the metallic particles, increasing the resistance provided that moisture is present to enable the particles to move. Further, the very small thermic effect of the Hertzian waves seems to evaporate the water between the particles; and as moisture returns between them the resistance again diminishes. A. D.

1740. *Decrement in Condenser Circuits with Air-gap.* **J. Zenneck.** (Ann. d. Physik, 13. 4. pp. 822–826, March, 1904. Physik. Institut, Strassburg.)—Whereas with a constant resistance, theory shows that a condenser discharge is *logarithmically* damped, it is here found that with an air-gap in the circuit the decrement is represented approximately by inclined *straight* lines. Hence, if one assigns a value of the logarithmic decrement to fit the slope of the straight lines at each point, it is seen that this value increases with time as the amplitude dies away. Thus, the resistance of the circuit increases as the amplitude decreases. [See also Abstract No. 1065 (1900).]

E. H. B.

1741. *Energy of Röntgen Rays.* **W. Wien.** (Phys. Zeitschr. 5. pp. 128–130, March 1, 1904. Phys. Inst. Würzburg, Feb. 1, 1904.)—On the supposition that the rays arise from the sudden stoppage of electrons, their energy is calculated. If an electron moving with one-third the velocity of light is suddenly stopped, then the energy radiated equals $3{\cdot}03 \times 10^{-13}$ ergs. If a stream of kathode rays moving with this velocity carries a current of a milliampere, the energy of the Röntgen rays arising from their stoppage is $12{\cdot}5 \times 10^{-5}$ watts.

R. S. W.

1742. *Ionisation of Air.* **N. N. Campbell.** (Nature, 69. p. 511, March 31, 1904.)—The saturation current through rectangular vessels lined with different metals and capable of alteration in size by the motion of one of the sides was measured. Two separate kinds of radiation causing the ionisation of the gas were indicated: (1) A radiation from the sides of the vessel, which is absorbed by some 5 cm. of air, and gives an ionisation proportional to the surface of the vessel; (2) a much more penetrating radiation giving an ionisation proportional to the volume of the vessel, which was diminished by surrounding the vessel with a lead screen. Lead, aluminium, zinc, and tin were examined. In the case of the first two the value of the surface ionisation was not altered by the screen. In the case of the other two metals it was decreased as well as the volume ionisation. In the case of tin and zinc, there appears to be a secondary radiation given off from the surface of the metal under the influence of penetrating radiation coming from outside.

J. J. S.

1743. *Conductivity Produced in Gases by an Incandescent Kathode.* **E. Merritt** and **O. M. Stewart.** (Phys. Rev. 18. pp. 239–255, April, 1904. Preliminary paper presented to the American Physical Society, Feb. 22, 1902.)—One aspect of this is the leakage current (of several milliamps.) between the terminals of the filament of a glow lamp; the negative end acts as a kathode, and at sufficiently high vacua produces kathode rays. An incandescent kathode acts much as if it were an ordinary kathode exposed to ultra-violet light. At higher pressures we have in both cases the current due to the kathode rays and that carried by the ions which are developed by these rays. At high vacua the kathode rays are the sole carriers of current. The gas in the tube does not remain a conductor for any considerable length of time; but there is at higher pressures some gradual change in the incandescent surface, which enables it to discharge kathode rays more and more freely, provided that an appreciable amount of residual gas is present. It is as if at higher pressures some material bearing a positive charge had been deposited upon the incandescent surface and intensified the effect of incandescence by a polarisation double layer being formed.

A. D.

1744. *Electric Osmose in Methyl Alcohol.* **A. Baudouin.** (Comptes Rendus, 138. pp. 898–900, April 11, 1904.)—On repeating the experiments of Perrin [see Abstracts Nos. 1486, 1487, and 1488 (1904)] in liquids other than water, especially methyl alcohol, the author finds that, in this alcohol, the electric osmose is considerable, but less, on the average, than under the same conditions in water, so that it is necessary to work with a p.d. of 250–300 volts instead of 60–100 volts. The osmose is proportional to the p.d. In methyl alcohol, just as in water, the sign of the osmose changes with the nature of the porous diaphragm employed. The osmose is very sensitive to traces of electrolytes dissolved in the alcohol. Potassium methoxide plays the same part towards methyl alcohol as potassium hydroxide does towards water; thus, it makes a positive diaphragm, *e.g.*, chromic chloride, negative, and so changes the sense of the osmose for such a diaphragm. A change in the sense of the osmose only takes place when the concentration of the hydrogen ions reaches such a value that a trace of free acid is formed; otherwise, the negative diaphragm is discharged, but does not become positive. This depends on the disappearance as ester of the principal part of the added acid. T. H. P.

1745. *Electric Current in Ionised Air in a Plane Condenser.* **G. Mie.** (Ann. d. Physik, 13. 5. pp. 857–889, April, 1904.)—A mathematical treatment of electrical conduction through ionised air, of which the chief results are exhibited graphically in six figures showing the relations between potential difference, current, &c., at various points between the kathode and anode. E. H. B.

1746. *Potential Variation during the Discharge in a Vacuum Tube.* **S. N. Taylor.** (Phys. Rev. 18. pp. 321–348, May, 1904.)—The mean potential during the discharge is deduced from calorimetric observations. Its variation under the same conditions is also obtained by connecting the terminals to the small condenser of a Braun tube and noting the excursions of the spot on a fluorescent screen. The chief results arrived at are as follows: With a low resistance in the circuit the discharge is continuous, when the resistance is increased sufficiently it becomes disruptive; the frequency decreases and the maximum potential increases as the resistance is further increased. A value of the resistance may be found when the discharge fluctuates between the continuous and disruptive form. The potential never falls to zero, but varies between a maximum and a minimum at each interruption. The rise to the maximum is slow, the fall from this point very rapid. The minimum potential during disruptive discharge is lower than the constant potential of continuous discharge. This indicates that there are more ions in the gas during the instant of actual transmission than at any time during the continuous discharge. R. S. W.

1747. *Conductivity of Air in Closed Vessels.* **A. Pochettino** and **A. Sella.** (Accad. Lincei, Atti, 13. pp. 550–559, May 15, 1904.)—The dispersion increases for about two days and then falls back nearly to its original value. The air seems to contain a radio-active emanation, which temporarily renders the walls of the vessel active. The following hypotheses are sufficient to explain the phenomena; penetrating radiations traversing the walls, and rays emitted directly from the walls account for the stationary amount of ionisation in closed vessels; the transient phenomena after the introduction of fresh air depend upon the nature of the air, that is, on the emanations it contains. The powerful increase in dispersion described by Geitel is not covered by this explanation, but its existence has been made doubtful by other experimenters and by Geitel's own later work. It is still an open question whether we must infer the existence of a spontaneous ionisation of the air or the presence in air of a radio-active gas either permanent or gradually losing its radio-active power; it is not very probable that we must come to this conclusion. A. D.

1748. *Theory of the Negative Glow.* **H. Pellat.** (Comptes Rendus, 138. pp. 1206–1208, May 16, 1904.)—The difference in colour between the negative glow and the positive column does not always mean that they give an entirely different spectrum, but merely a change in the relative intensities of certain rays or bands, and by certain experimental arrangements, which are given in the paper, it is possible to pass from one spectrum to the other gradually. If the tube where the positive column is present is constricted, or if the discharge be compressed by the action of a magnetic field, the spectrum changes into one more like the negative glow. It is therefore concluded that the negative glow is caused by the collision of ions, moving with great velocity out of the dark space, with neutral molecules, and not by the collision of secondary ions which would be moving with smaller velocity since they start in a weaker field. The positive column, on the other hand, is caused by the collision of more slowly moving ions with the neutral molecules of the gas. R. S. W.

ELECTRICAL PROPERTIES AND INSTRUMENTS.

1749. *Influence of Temperature on the Electrical Conductivity of Sodium.* **A. Bernini.** (N. Cimento, 6. pp. 21–30, July and Aug., 1903. From the Instituto Fisico della Università di Bologna.) — Doubting the results of Matthiessen, the author has redetermined the conductivity of sodium at temperatures from 0° to 132° C., with results similar to those subsequently found for potassium [see Abstract No. 1145 (1904)]. The specific resistance at $0° = 0{\cdot}095208$, and at $132° = 0{\cdot}135584$, and between these temperatures the conductivity diminishes proportionately with increase of temperature. The coefficient of temperature is greater for the liquid than for the solid state, a decided rise in the resistance occurring at the point of fusion, and the author considers this a good method for the determination of the melting-point of this and similar metals. W. H. Si.

1750. *Alteration of Conductivity of Metal Powder by Induction.* **H. Muraoka** and **T. Tamaru.** (Coll. Sci. and Engin., Mem. Kyōto, 1. 1. pp. 20–27, 1903. In German.)—The authors further investigate the conductivity of metal powders, as carried out by Sundorph [see Abstract No. 1717 (1899)]. The reduction of resistance was found to be due to the self-induction of the galvanometer, and to determine whether the discharge is oscillatory the powder included between plates is considered as a condenser. This is worked out, and the conclusion arrived at that, assuming that the resistance-reduction with a certain thickness of the powder increases with the compressed state of the material, it follows that this reduction, at a certain thickness, increases with the inducing current, and decreases with increasing volume. Experiments were made to test this, and, though not conclusive, they indicate qualitative agreement with the theoretical deductions. In conclusion it is remarked that the tendency in making coherers is to keep the volume of the powder as small as possible. This is probably for the very reason pointed out, that the reduction of resistance increases with decreasing volume, as is shown also by the experimental results given. L. H. W.

1751. *Dielectric Losses in Condensers.* **I. Mościcki** and **M. Altenberg.** (Acad. Sci. Cracovie, Bull. 1. pp. 46–49, Jan., 1904.)—To study the dielectric losses in condensers submitted to the action of alternating currents a special form of condenser is used. It consists of a wide thin-walled glass tube sealed to a pointed, thick-walled tube, the outer surface of the former being silvered over and the inside filled with mercury. Contact on the outside is made by two sliding rings of sheet copper, the inside terminal consisting of a copper wire immersed in the mercury. The method consisted in noting the rise in temperature of the mercury due to the passing of an alternating current through the thin upper tube for a known time. The energy equivalent to this heat was determined by previously passing through the outer surface a direct current of known pressure and strength. Three condensers of 0·29 mm., 0·32 mm., and 0·48 mm. respectively, were tested with an alternating current of 50 periods per sec. and a pressure of 2,000 to 11,000 volts. At constant pressure the percentage losses decreased with the thickness of the glass and increased with the frequency, whereas according to Steinmetz the losses should remain constant notwithstanding alteration in potential and frequency. To account for this difference, the authors have worked out a formula where the energy losses $W=K.\delta\left(\frac{V}{\delta}\right)^{2+\alpha}.f^{1+\beta}$, $\frac{V}{\delta}$ representing the fall of potential through the thickness of dielectric δ; $f=$ the frequency; α and β are exponents such that $0<\alpha<1$ and $0<\beta<1$.

E. S. A. R.

1752. *Conductivity of Solutions of Radium Bromide.* **F. Kohlrausch** and **F. Henning.** (Deutsch. Phys. Gesell., Verh. 6. 5. pp. 144–146, March 15, 1904.)—It was possible that radium salts might possess abnormal properties as electrolytes, in consequence either of the high atomic weight of the element or of its intense ionising properties. This, however, is not the case, as its behaviour is quite normal over the range from N/20 to N/12,000. The molecular conductivities, Λ, and temperature coefficients $\frac{1}{\kappa}\frac{d\kappa}{dt}$ were as follows:—

Concentration (gm. equivalents per litre).	Λ	$\frac{1}{\kappa}\frac{d\kappa}{dt}$
0·0490	100·0	0·0221
0·01715	106·6	—
0·00842	110·7	—
0·001361	117·8	0·0225
0·000712	120·1	—
0·000305	121·7	—
0·0000875	123·6	—

For zero concentration the limiting value Λ_0 would be 125, and the mobility of the radium ion 57·4, as compared with 56 for ½Ba, and 53 for ½Sr and ½Ca. The temperature coefficient of the ion is 0·024 at 18° C. Runge and Precht's value (258) for the atomic weight of radium would give an altogether abnormal value (67) for the mobility of the radium ion.

T. M. L.

1753. *Dielectric Constants of Some Liquids.* **Miss M. Petrowa.** (Jurn. Russk. Fisik. Chimičesk. Obščestva, 36. No. 4b. pp. 93–99, 1904.)—Borgmann's method, based on the displacement of the nodes shown by vacuum tubes, may be applied to a determination of the dielectric constants of insulating liquids, the latter being filled in successively into the same condenser. The condenser used by the authoress had the shape of a test-tube fitted with two plates, serving as armatures, and a cock. The errors of observation did not exceed 2·5 per cent. The following values were found :—

Liquid.	Dielectric Constant.	Liquid.	Dielectric Constant.
Xylol	2·11	Chloroform	4·61
Benzol	2·8	Amyl benzolate	4·84
Sulphuric ether	4·28	Liquid air	1·33

The influence of variations in temperature proved quite inappreciable, and a piece of radium approached to the tube did not exert any influence on the dielectric constant. A. G.

1754. *Electrical Conductivity and Fluidity of Solutions.* **R. Hosking.** (Phil. Mag. 7. pp. 469–484, May, 1904.)—In a previous paper [see Abstract No. 2291 (1902)] the author and Lyle showed that the specific molecular conductivity and the fluidity of the solutions used became zero at the same temperature, viz., —35·5° C. Kohlrausch, independently, working with dilute solutions, found both properties tended to a zero value of —39° C. The author has continued these experiments with solutions of lithium chloride at high concentrations. The original form of glischrometer was used for the determination of the viscosity, and the electrical resistance of the cell measured by a modification of Kohlrausch's method, using a double commutator and moving coil galvanometer. The bath containing the dilatometer, glischrometer, electrolytic cell, thermometer, and stirrer were placed in a bath enclosed in an iron jacket heated from below. Eight solutions were made with a density at 15° C. of 0·9992–1·2319, a concentration of 0·00645–10·71, viscosity 0·01144–0·00805, resistance 242700–1440 ohms, specific molecular conductivity 87·1–8·8. First obtaining the smoothed values at 0°, 10°, 20° . . . 100° of the density, viscosity, and resistance, the concentration values at the various temperatures were deduced from a knowledge of the connection between the density and concentration at any one temperature, *e.g.*, 18° C. From the results the author found that the fluidity increased more rapidly than the conductivity, both being expressed algebraically as the *m*th power of the temperature measured from some fixed point below 0° C., which was the same (— 48·1° C.) for all solutions. From the fluidity and conductivity curves the temperature axis was intersected at the above point which, therefore, represents zero conductivity and fluidity. In the first solution, the ionisation remained constant at all temperatures, but for the other solutions there was a marked decrease with rise of temperature, and this became stronger the stronger the solution. Discussing the results from the point of view of Kohlrausch's recent views on the mechanics of electrolysis, the author suggests that the lithium ion, moving very slowly, may be considered the centre of a larger atmosphere than the fast moving chlorine ion, and probably with rise of temperature the atmosphere may approach the same size. E. S. A. R.

1755. *Thomson Effect in Alloys of Bismuth and Tin.* **S. C. Laws.** (Phil. Mag. 7. pp. 560–578, May, 1904.)—The author investigates the Thomson effect, first in pure bismuth, and then with bismuth-tin alloys with percentages of tin of 1·23, 3·01, 10·0, and 23·6 per cent. ; the preparation of the specimens, the apparatus, and the method adopted, which was that of Haga (Ann.

de l'École Polyt. de Delft, 1. p. 145, 1885; 3. p. 43, 1886), are described. For pure bismuth the value of σ (specific heat of electricity, of Thomson) was — 767 ergs per c.g.s. unit of current per 1° C. as compared with Battelli's — 582 ergs (Accad. Sci. Torino, 22. p. 548, 1887). From the summary of results, given also in the form of a curve, it is seen that the addition of 1 per cent. of tin increases the Thomson effect to more than twelve times that obtained with pure bismuth, and this effect continues until with 8 per cent. tin the effect is fifteen times that with bismuth, and is six times greater than that found for any substance previously examined. With a greater percentage of tin σ decreases at an increasing rate until, in the case of pure tin, the value is only 1/300 of that for pure bismuth. In the first three alloys the values of σ increase much more rapidly than the absolute temperature, and the Thomson effect vanishes in each at — 60°, — 90°, and — 190° respectively; alloy No. 4 shows, however, a Thomson effect proportional to the absolute temperature. The experiments thus confirm Haga's statement that σ is not necessarily proportional to the absolute temperature. L. H. W.

1756. *Observations with the Schloemilch Wave-detector.* **M. Reich.** (Phys. Zeitschr. 5. pp. 338–340, June 15, 1904. Göttingen, Physik. Institut.)—The author refers to the Schloemilch electrolytic cell [see Abstract No. 211B (1904)], and describes a method of making the microscopic anode, using for this purpose a fine capillary tube with a platinum wire inserted and fused in, the whole tube and wire being drawn out together at a highly heated part and the glass then broken off short. Schloemilch has given no explanation of the physical process involved in the detector action; Fessenden, however, in his barreter, which is practically identical with this cell, considers the action to be a bolometric one, the electrolyte being warmed, and the resistance thereby reduced. In the author's experiments it was found that the current when a wave arrived could easily reach ten times its normal value. Assuming even that the electrolyte (sulphuric acid here) at the small anode were warmed up to the boiling-point, the resistance would, however, not sink to one-tenth its value (according to Richarz, Wied. Ann. 47. p. 579, 1892), and the following observations are held also to contradict the views of Fessenden. Using only a half-wave produced by the non-oscillatory discharge of a condenser, the discharge through the cell in one direction (small electrode anode) gives only a very small deflection on a galvanometer. With the discharge in the opposite direction the deflection is large and *much greater than that obtained by discharging direct* through the galvanometer. With increasing p.d. at the condenser the deflection increases, also with increase of capacity, but not proportionally; and there is a definite discharge energy which gives the greatest efficiency as regards ratio of deflection to energy of discharge. All these observations are held to point to anodic polarisation, as with a bolometer effect the deflection could never have been greater through the cell than direct through the galvanometer (without cell). Curves taken with a Duddell oscillograph also bear out this view, and these are reproduced. The author considers it possible that some sort of dissolution of the anode takes place whereby oxygen disappears at the anode, as has been shown by Ruer to occur with simultaneous flow of a weak direct- and alternating current. [See Abstract No. 214 (1904).] Ruer also showed that this effect of the direct current was a purely chemical oxidation. The same holds in the case of the detector, for with the aid of two additional electrodes the effect of the direct current could be assisted or weakened by development of oxygen or hydrogen just beneath the anode, and the development of hydrogen was found to be more favourable with a strong direct current, of oxygen for a weak current; and the same with strong and weak waves respectively. L. H. W.

ELECTROPHYSIOLOGY AND ELECTROTHERAPEUTICS.

1757. *Heat Rays in Finsen's Light Treatment.* **W. Scholtz.** (Brit. Medical Journ. 2268. p. 1442 C, June 18, 1904. From Berlin. Klin. Woch, May 2, 1904.)—The author uses a special "triplet lamp," with separate pressure and cooling lenses, possessing exceptionally intense illuminating power, and producing a large number of heat-rays. His experiments tend to show that a large amount of the action of the light treatment is due to the penetrating heat-rays, and not solely to the violet and ultra-violet rays, as is usually maintained. When the rays from his lamp were directed on the skin for twenty minutes a moderate erythema developed in twenty-four hours, but if they were passed through a pale yellow light filter or through a blue light filter, no change was seen. If a few drops of a methylene-blue solution are injected into the subcutaneous tissue, the action of the penetrating rays will be found to be locally intense, producing a hard infiltration of the part. When the light is passed through a sheet of gelatine no heat action is seen, but if the gelatine is coloured blue the heat-rays are absorbed and act on the anterior surface almost immediately, and soon melt a hole through the film. The author considers that the deeper acting heat-rays can exert an action on tissue and bacteria, which in certain conditions such as lupus, in which the brownish nodules are found, may even act selectively. H. W. P. Y.

REFERENCES.

1758. *Rowland-Gilbert Experiment.* **P. Lebedew.** (Ann. d. Physik, 11. 2. pp. 442–444, May, 1903. Physik. Lab. d. Univ., Moscow, Feb., 1903.)—Gilbert's research, in which he endeavoured with negative results to obtain electrical currents in conductors by moving these in the ether, with a view to founding an explanation of terrestrial magnetism, has been modified by the author, who takes advantage of the much greater velocity (30,000 m. per sec.) of the earth's travel in space. There was no e.m.f. obtained of as much as 3×10^{-8} volt. A. D.

1759. *Electric Osmosis.* **J. Perrin.** (Comptes Rendus, 136. pp. 1388–1391, June 8, 1903.)—It is recognised that electric osmosis through a porous partition is due to the liquid and the partition acquiring opposite electrifications, *e.g.*, if the partition becomes charged negatively, the liquid is charged positively and moves in the same sense as the potential applied. Conversely, it is found that if a liquid is forced mechanically through such a partition it is positively charged. If fine powder of the same material as the partition is in suspension in the liquid, the powder moves in the reverse direction when an electric field is applied. The author has carried out experiments to determine what liquids are susceptible to electric osmosis, and finds that osmosis is strongly shown only in those which have a large specific inductive capacity, *i.e.*, which give rise easily to ionisation, such as water, methyl alcohol, ethyl alcohol, &c. [For later results see Abstracts Nos. 1486, 1487, and 1488 (1904).] W. R. C.

1760. *The Theory of Ionisation by Collision.* **J. Stark.** (Phil. Mag. 6. pp. 116–119, July, 1903.)—Remarks on the experiments and views of J. S. Townsend, the author, and others on the potential difference required to impart to ions a velocity sufficient to enable them to produce new ions on collision with molecules in a gas. [See Abstracts Nos. 87 and 1511 (1903).] J. J. S.

1761. *Dispersion of Electric Waves in Water.* **E. Marx.** (Phys. Zeitschr. 4. pp. 531–532, July 1, 1903.)—A discussion of the various methods used for obtaining the dielectric constant for water by electric waves. It is considered that the important problem can be solved only by a method which utilises electric waves of *continuously* variable length. E. H. B.

1762. *E.M.F. Required to Produce Discharge in Gases.* **D. Pacini.** (Accad. Lincei, Atti, 12. pp. 27–33, July 5, 1903.)—The potential difference for which the discharge between a point and a plane takes place in various gases is observed, and it is found that the p.d. required to start the discharge is greater when the point is positive than when it is negative. The curves giving the relation between length of gap and p.d. required to start the discharge are given; they are convex towards the p.d. axis. It is also shown that for various gases the resistance increases with diminution of the mean free path of the molecules. S. G. S.

1763. *Electric and Magnetic Resistance for Oscillations.* **J. Zenneck.** (Ann. d. Physik, 11. 5. pp. 1135–1141, July 7, 1903. Physik. Institut, Strassburg.)—Treats the electric and magnetic resistances of circuits by similar methods, giving for each for alternating currents an expression in terms of Bessel's functions. The paper concludes with approximate formulæ for certain cases, and figures illustrating their degree of accuracy. [See also Abstracts Nos. 742 (1903) and 844 (1904).] E. H. B.

1764. *Crystallisation in an Electrical Field.* **W. Schmidt.** (Phys. Zeitschr. 4. pp. 480–481, June 1, 1903.)—On allowing a solution of sulphur in carbon bisulphide to evaporate between two brass plates with a potential difference of about 40,000 volts, it was found that the separation of crystals occurred at the anode, while the kathode was entirely free from crystals. The author suggests that the sulphur crystals assume a negative character in *statu nascendi.* D. H. J.

1765. *Electric Resistance.* **G. Crivellini.** (Elettricità, Milan, 22. pp. 468–469, July 26, 1903.)—A sketch of a mathematical theory of conduction in metals, based on an action of the ether between atoms different from that in free ether. Bad conductors are those whose atoms inhibit intra-molecular discharges. The smaller the intra-molecular distances the easier the intra-molecular discharges, which explains the effect of cold and the effects of passing a current through magnetic metals—in which the particles come to be at greater distances along the lines of flow—and in diamagnetic metals, in which the intra-molecular distances become smaller. In a conductor devoid of magnetic character the resistance is proportional to the square of the binomial of linear dilatation relative to 100°. A. D.

1766. *Electric Resonance.* **T. Mizuno.** (Coll. Sci. and Engin., Mem. Kyōto, 1. 1. pp. 33–39, 1903. Electrician, 51. pp. 654–655, Aug. 7, and pp. 730–732, Aug. 21, 1903.)—The author describes in the first paper some experiments, useful for lecture purposes, on resonant circuits. In the two other papers similar experiments are described at greater length, and the measurements made are discussed. L. H. W.

1767. *The Filings Coherer and Wireless Telegraphy.* **T. Mizuno.** (Coll. Sci. and Engin., Mem. Kyōto, 1. 1. pp. 28–32, 1903.)—The author describes some experiments with coherers. In one of these two condensers of small capacity were charged by a battery giving 20 volts. When the local circuit was open before charging, on closing it coherence took place. When, however, the circuit was first closed, no coherence took place. In another experiment a coherer was placed, insulated, between the plates of a condenser connected to a Wimshurst machine. Coherence took place when the p.d. was 500 volts. An arrangement of circuits for wireless telegraphic purposes is then described. L. H. W.

1768. *Magnetic Effect of Electric Convection.* **N. Vasilesco-Karpen.** (Soc. Franç. Phys., Séances, 3. pp. 162–172, 1903.)—The magnetic effect of a convection current is identical (experimental errors apart) with that of an equivalent conduction current. The presence of dielectrics makes no difference: that of conductors produces identical effects in both cases. The transport of charge by a rotating disc is complete when the forces of electromagnetic inertia are null. The theory is developed. A. D.

1769. *Rowland Effect.* **F. Himstedt.** (Ann. d. Physik, 13. 1. pp. 100–123, Dec., 1903. From the Freiburger Berichte, 14. p. 85, 1903.)—Quantitative experiments, described and tabulated. Discussion of Crémieu's papers. Results in harmony with Rowland's theory. A. D.

1770. *Magnetic Effect of Electric Convection.* **G. Picciati.** (Accad. Lincei, Atti, 13. pp. 181–185, Feb. 21, 1904.)—Pender and Crémieu say [see Abstract No. 1482 (1904)] that caoutchouc on the rotating disc and armatures affected Crémieu's earlier results; Vasilesco-Karpen says [see Abstract No. 1768 (1904)] that the presence of dielectrics makes no difference. According to theory the latter view is correct. A. D.

1771. *The Crémieu-Pender Discovery.* **W. Sutherland.** (Phil. Mag. 7. pp. 405–407, April, 1904.)—Discusses in the light of the author's theories the fact that the difficulty in reconciling the apparently contradictory results obtained by Rowland, Röntgen, Himstedt, and others on the one hand, and Crémieu on the other, concerning the magnetic effects of electric convection, was traced to the one fact that Crémieu covered his metallic electrified surfaces with solid dielectric. E. H. B.

1772. *Radiation from an Alternating Circular Current.* **W. McF. Orr.** (Phil. Mag. 7. pp. 336–341, April, 1904.)—The author has previously given formulæ expressing the magnetic force at a great distance from a perfect conductor in the form of a very thin circular ring which carries an alternating current [see Abstract No. 387 (1904)]. The present paper develops a solution which is simply stated in terms of Bessel's functions. The mathematics of the paper cannot be much further condensed, but one of the chief results may be stated as follows: If the current is a simple harmonic function of the time, and if the wave-length in free space is small compared with the radius, the radiation approximately depends only on the mean value of the square of the current averaged round the circle, and is otherwise independent of the law of variation from point to point. E. H. B.

1773. *Atmospheric Electricity on the Electron Theory.* **H. Ebert.** (Monthly Weather Rev. 31. pp. 229–232, May, 1903. Lecture delivered before the Swiss Society of Natural Sciences, Geneva, 1902. Translated from the Meteorologische Zeitschrift.)—A valuable *résumé* of recent work as to electrons, ionisation and precipitation of supersaturated vapour by the presence of ionic nuclei. Suggestions are made for applying the electron theory to the explanation of various problems in meteorology. E. H. B.

1774. *Differences of Potential between Liquid and Gas.* **A. Campetti.** (Accad. Sci. Torino, Atti, 38. 14a. pp. 494–508, 1902–1903. Phys. Inst. Univ., Turin.)—Several cases are examined, in which the liquid and the gas act chemically upon one another. Sulphuric acid gives high values, about 0·112 volt with air and 0·244 volt with ammonia gas. A. D.

1775. *Tesla Point Discharges.* **K. v. Wesendonck.** (Phys. Zeitschr. 4. pp. 465–469, May 15, 1903.)—Detailed description of the experimental arrangements for observing the special phenomena when Tesla discharges occur at sharp points. [See Abstract No. 350 (1903).] E. H. B.

1776. *Sparks through Insulating Liquids.* **A. Maresca.** (N. Cimento, 5. pp. 315–322, May, 1903. Phys. Inst. Univ., Parma.)—The course of the phenomena resembles that of sparks in air, and Cardani's method (N. Cimento, 1901) of finding the proportion of the whole energy which is absorbed in the sparks is applicable to liquids as well as gases. A. D.

1777. *The Duddell Circuit in Telegraphy.* **G. Campos.** (Atti dell' Assoc. Elettr. Ital. 7. pp. 223–244, April–June, 1903. Paper read before Milan Section, March 13, 1903.)—Develops the theory and shows how part of the energy produced under the form of alternating currents in the Duddell circuit may irradiate and be conveyed to other circuits. Suggested applications to rapid telegraphy and telephony without wires, of which Cooper Hewitt's use of his mercury vapour lamp is a particular case. A bibliography of the Duddell circuit is given. A. D.

1778. *Stratified Discharge through Rarefied Gases.* **K. R. Johnson.** (Phys. Zeitschr. 4. pp. 432–434, May 1, 1903.)—The author has previously pointed out that, under high frequencies, gases cannot be said to have a true resistance. Some further remarks are given upon the discharge of high-frequency currents through gases. [See also Abstract No. 1468 (1903).] E. C. C. B.

1779. *Ionisation Produced by Phosphorus.* **J. Elster** and **H. Geitel.** (Phys. Zeitschr. 4. pp. 457–460, May 15, 1903.)—An account of some experiments which the authors interpret as showing the presence of ions, in the sense usually understood. They oppose the views of Schmidt. [See Abstract No. 85 (1904).] R. S. W.

1780. *Ionisation of Air by Water.* **F. Himstedt.** (Phys. Zeitschr. 4. pp. 482–483, June 1, 1903. Ann. d. Physik, 12. 1. pp. 107–123, July 21, 1903. From the Ber. d. Naturf. Gesell. zu Freiburg, 13. p. 101, 1903.)—This paper contains an account of investigations of the radio-activity of air that has been in contact with water, as in a pump driven by a jet of water drawn from the mains. Later work on the subject by H. F. Rausch (von Traubenburg) is described in Abstract No. 1495 (1904).] T. M. L.

1781. *Electrical Intensity in the Positive Column.* **H. A. Wilson.** (Phil. Mag. 6. pp. 180–188, July, 1903.)—A continuation of former experiments [see Abstracts Nos. 1114 and 1882 (1902) and 561 (1903)]. The results are extended to currents much smaller than in the earlier experiments. R. S. W.

1782. *Objective Demonstration of Condenser and Induction Currents.* **F. Wittmann.** (Ann. d. Physik, 12. 2. pp. 373–384, Aug.; 12. 4. pp. 805–813, Oct., 1903. Techn.-Phys. Lab. des Polytechnikums, Budapest.) **J. Zenneck.** (Ann. d. Physik, 13. 4. pp. 819–821, March, 1904. Phys. Inst., Strassburg.)—Wittmann considers the Braun tube unsuitable for demonstrating the current curves owing to the small intensity of the kathodic spot, and describes experiments made with his own oscillograph, which is on the Blondel-Duddell principle. A number of curves are reproduced, and the results obtained are compared with the calculated values. In the second paper the author shows how the method can be used for investigating the charge and discharge currents of condensers, using a rotating contact maker and a mirror-shifting device, which acts at the point when the circuit is open. Curves are given. Zenneck, in reply to Wittmann's assertion that the Braun tube is unsuitable for such uses, gives reproductions of curves showing good definition. He considers that the Braun tube has the merit of absence of inertia, and expresses doubt whether an oscillograph with a period of 1/1700 sec. can give the correct form of an oscillation of frequency 800 per sec. L. H. W.

1783. *Electrons and Meteorology. Ionisation of the Air.* **J. Don.** (Elect. Rev. 54. pp. 399–401, March 4, and pp. 612–613, April 15, 1904.)—The author has made observations at Peterhead Academy with an electronscope, *i.e.*, an ordinary gold-leaf electroscope, mounted on a glass box in such a way that air can be drawn through the box at the rate of about 0·2 cub. ft. per hour, and the fall of the leaves be watched—an experiment lasting several hours. It results that the humidity of the air, as measured and felt, has little to do with the rapidity of the discharge. Data of five weeks' observations are given. In the second paper the observations are continued with two improved electronscopes or with one, charged alternately positive or negative. A leak has been detected, *i.e.*, a discharge when no air was drawn through the instrument. If this leak is allowed for, the passage of the air would sometimes appear to have caused the leaves to diverge. But no real increase in divergence has been observed. H. B.

1784. *Flame Arcs.* **W. B. v. Czudnochowski.** (Deutsch. Phys. Gesell., Verh. 6. 4. pp. 137–138, Feb. 29, 1904.) **E. Rasch.** (Deutsch. Phys. Gesell., Verh. 6. 4. pp. 139–140, Feb. 29, 1904.)—A further discussion of the points raised in the papers dealt with in Abstracts Nos. 629, 630 (1904). W. H. S.

1785. *Corpuscles in the Positive Column.* **H. Pellat.** (Comptes Rendus, 138. pp. 476–479, Feb. 22, 1904.)—The shape of the discharge deflected by a magnetic field is calculated on the supposition (1) that it is formed by moving corpuscles, (2) by moving positive ions, and this is compared with experiment. The conclusion is drawn that the positive column is due chiefly to moving corpuscles. R. S. W.

1786. *Relation between Light and Electrical Conductivity in Flames.* **F. L. Tufts.** (Phys. Zeitschr. 5. pp. 157–158, March 15, 1904. From the English.)—It is known that the introduction of chloroform into a flame which is coloured by potassium or lithium salts greatly decreases the colour intensity. Smithells, Dawson, and Wilson concluded from their experiments that it had no corresponding effect on the electrical conductivity produced by the salts. The author sees reasons for doubting this result. His experiments are carried out by a method previously described [see Abstract No. 1178 (1904)]. The chlorides of lithium, sodium, and calcium are used. The light intensity is measured by a Glans spectro-photometer; the red lithium line, the yellow sodium, and the red and green bands of calcium being used. Chloroform reduces the light intensity of the lithium by 64 per cent., and the current produced by 4 volts by 62 per cent. Corresponding figures for sodium are 78 and 73 per cent. The intensity of the red calcium line is reduced by 71 per cent., that of the green by 51 per cent., the current by 43 per cent. R. S. W.

1787. *Rate of Generation of Ions in the Atmosphere.* **A. Schuster.** (Manchester Lit. and Phil. Soc., Mem. 48. 12. pp. 1–6, March, 1904.)—Description of a method of measuring the rate at which recombination of ions takes place in a particular sample of air. When the number of ions per c.cm. is known, the rate at which the ions are being produced can be calculated from the measurement made. A modification of the apparatus devised by Ebert was used. J. J. S.

1788. *Simple Apparatus for demonstrating Oscillatory Discharges.* **A. Winkelmann.** (Zeitschr. Instrumentenk. 23. p. 149, May, 1903.)—The author gives an illustration of a double-bulb vacuum tube, the two bulbs being joined. In the one bulb is placed a piece of corundum and in the other a piece of scheelite; kathode rays make the former give off a red luminosity and the latter a green light. If a non-oscillatory discharge is passed through the tube only the mineral having the kathode above it will light up; an oscillatory discharge will cause them both to glow. The apparatus is made by Gundelach. L. H. W.

1789. *Electric Conductivity of Metallic Oxides and Sulphides.* **E. van Aubel.** (Phys. Zeitschr. 4. pp. 551–552, July 15, 1903; 5. pp. 303–305, June 1, 1904. From the French.) **F. Streintz.** (Phys. Zeitschr. 5. pp. 159–160, March 15, 1904.)—Van Aubel refers to the investigations of Streintz [see Abstract No. 473 (1903)], and points out that he has himself been able to obtain a definite though very weak Hall effect with molten PbS, of the same sense as that obtained with pure bismuth though Streintz had reported only negative results. Then follows an argument as to the difference between his own and Streintz's experiments, to which Streintz replies in the second paper referred to. [See also Abstracts Nos. 662 and 663 (1903).] L. H. W.

1790. *Electric Resistance of Metals under Pressure.* **S. Lussana.** (N. Cimento, 5. pp. 305–314, May, 1903. Phys. Inst. Univ., Siena.)—The author defends his results [see Abstract No. 147 (1900)] against E. Lisell, who contests the conclusion that pressure causes a temporary and a permanent change in the resistance, the former being considerable and dependent on the previous history, the latter feeble and dependent only on the amount of variation in the pressure. Lisell recognises only a temporary change in the resistance, which, according to him, does not depend on the previous history of the metal as regards pressure upon it. A. D.

1791. *The Volta Effect.* **G. C. Simpson.** (Phys. Zeitschr. 4. p. 480, June 1, 1903. Geophysikalisches Institut, Göttingen.)—The author noticed in working with a sensitive quadrant electrometer joined to a long copper wire, itself protected from electric fields by a wooden case covered with tin-foil, that the wire slowly acquired a positive charge when insulated and left to itself, the charge varying with the nature of the metal. He made experiments to confirm this, and obtained values which agree well with values of the p.d.'s of the voltaic series with zinc (which was used as the other metal). The charging could be accelerated by increasing the ionisation of the air in the room by Röntgen rays. Sodium and magnalium alone gave negative values. L. H. W.

1792. *Resistance Comparator.* **R. A. Lehfeldt.** (Phil. Mag. 5. pp. 672–674, June, 1903. Communicated by the Physical Society.)—On account of the objection to using sliding contacts, the author has designed a comparator for temperature measurements in an investigation on the Joule-Thomson effect. The apparatus consists of two 99-ohm coils connected to a circular set of twenty 0·1-ohm coils, so that a switch connected to the galvanometer alters the resistance by steps of $\frac{1}{1000}$ part for each speed. The galvanometer deflections are easily interpolated to $\frac{1}{100}$ part of the scale, giving an accuracy of one part in 100,000 for the comparator. E. S. A. R.

1793. *Galvanometer Deflection over a Disc.* **L. Sandino.** (Elettricità, Milan, 23. p. 16, Jan. 8, 1904.)—A galvanometer needle is deflected over a disc as it would be over a wire, both bearing a similar current. The different lines of flow through the disc co-operate in producing this result. A. D.

1794. *Induction in a Vacuum.* **J. Härdén.** (Phys. Zeitschr. 5. pp. 75–76 Feb. 1, 1904. Wissenschaftl. Laboratorium der Gen. El. Co. Schenectady, U.S.A., Nov. 17, 1903.)—A vacuum tube containing various substances—*e.g.*, air, iron chloride, iron filings, magnetite, &c., in succession—is placed as the core of a helical winding. One half of the helix is connected to condensers, which receive rapid alternation from the secondary of a transformer; the other half is connected to a spark micrometer. By measuring the spark the author measured the power of the substances in the tube to transmit the oscillation from one circuit to the other. P. E. S.

1795. *Automatic Electromagnetic Interrupter.* **J. J. Taudin Chabot.** (Phys. Zeitschr. 5. pp. 89–92, Feb. 15, 1904.)—Adjustment of this, with telephone and microphone, so as to render it sensitive to sound waves or to ether waves. A. D.

1796. *Properties of Electrical Conductors.* **P. R. Heyl.** (Frank. Inst., Journ. 157. pp. 201–212, March, 1904.)—A *résumé* of the physical properties exhibited by matter conducting electricity. R. A.

1797. *Quartz-Thread Vertical Force Magnetograph.* **W. Watson.** (Phil. Mag. 7. pp. 393–399, April, 1904. Communicated by the Physical Society.)—The instrument resembles Threlfall's quartz-thread gravity balance, and the moment of inertia is reduced, after Eschenhagen, in order to detect quick period variations, by using two magnet bars 8 cm. in length, 1 mm. in diam. A platinised quartz plate serves as mirror. The magnets are fixed, by means of platinum straps, to two projections from this plate, to which the two horizontal quartz threads are attached. Temperature compensation is effected by displacing—with the aid of a weight sliding on one of the magnets—the centre of gravity of the movable system in such a way that the decrease in vertical force due to a rise of temperature will be balanced by the increase in the stiffness of the thread. For this work the author had the help of F. E. Smith, of the National Physical Laboratory, for which a second instrument has been constructed. The author describes how he made his magnetograph.

H. B.

1798. *New Sensitive Hot-wire Voltmeter.* **R. Threlfall.** (Phil. Mag. 7. pp. 371–376, April, 1904. Communicated by the Physical Society.)—The hot wire, about 6 cm. long and of fine gilded silver, is stretched between two pillars. A spring produces a slight sag in it which is measured by a mirror attached to the hot wire and to a parallel fixed wire acting as a hinge. The tension of the hot wire can be adjusted by a graduated micrometer screw. One size of instrument described has a range from 0·03 to 0·45 volt. H. F. H.

1799. *An Electroplating Brush.* **H. S. Allen.** (Roy. Philosophical Soc. Glasgow, Proc. pp. 5–7, 1904. Abstract.)—In Blythswood's grating ruling engine an attempt is being made to correct the errors of ruling by correcting the individual teeth of the ratchet wheel. If a tooth is too wide the superfluous metal is removed by filing or burnishing, but when the tooth is too small it is necessary to add metal to it, and the author has designed an electroplating brush for the purpose. A small metallic brush projects from the partially closed end of a tube containing a solution of a salt of the metal to be deposited. This tube is connected to the positive terminal of a 2-volt cell, while the wheel is connected to the negative terminal. Any thickness of metal can be deposited by simply brushing the surface of the wheel.

E. C. C. B.

1800. *Internal Friction of a Liquid in a Magnetic Field.* **C. Carpini.** (Accad. Lincei, Atti, 12. pp. 341–348, May 3, 1903.)—There is apparently an increase of internal friction in a magnetic liquid in a magnetic field; but this is apparently so nearly equivalent to the Foucault effect due to the conductivity of the liquid that it is probably wholly due to this, and that apart from this the internal friction of magnetic liquids is independent of the magnetic field. A. D

1801. *Rotation of Electrolytes in a Magnetic Field.* **O. Urbasch.** (Zeitschr. Elektrochem. 9. pp. 511–512, June 18, 1903.)—The author had observed that when a layer of water is placed over concentrated sulphuric acid and placed in a magnetic field rotation took place [see Abstract No. 1905 (1902)]. This was called in question by Drude, but is now confirmed by Nernst. [See also Abstract No. 579 (1903).]

A. F.

1802. *Working of the Wehnelt Interrupter.* **Gagnière.** (Archives d'Él. Médicale, 12. pp. 243–257, April 10, 1904.)—The author describes experiments on the rupture of the current and its causes, the luminous phenomenon and the gaseous envelope succeeding it, the mechanism of the expulsion of the gases, the seat of the luminous phenomenon, and the appearance of the secondary spark of a coil with the Wehnelt interrupter. The chief conclusions arrived at are: The luminous and the electrolytic phenomena can be separated. The action of the interrupter is such that the electrolytic phenomena take place at the same time that the layers of liquid surrounding the point are heated up by the current. At a point where the current density is greatest the liquid is rapidly brought to its boiling-point and vaporised, the current being interrupted at this instant. The luminous effect produced at the same instant takes place between two layers of liquid, and a gaseous film completely envelopes the platinum point when the luminosity has gone. This disappears in turn owing to a rapid diminution of pressure in the interior, and the gases are expelled. Owing to the gaseous envelope the platinum is kept continuously at a temperature lower than the boiling-point of the liquid; thus no cooling is required, as would be thought necessary. [See also Abstract No. 1129 (1904).] L. H. W.

1803. *Permanent Magnets.* **H. Weichsel.** (Elektrotechn. Zeitschr. 25. pp. 34–35, Jan. 14, 1904.) **R. Hiecke.** (Elektrotechn. Zeitschr. 25. pp. 35–36, Jan. 14, 1904.)—These letters are in reply to the paper of Emde [see Abstract No. 638 (1904)], and contain results of experiments, the differences in which lead to an argument.

1804. *Magnetic Observations in Madagascar.* **P. Colin.** (Comptes Rendus, 136. pp. 1298–1301, June 2, 1903.)—The author has determined the magnetic elements at nine more stations, on a line 60 km. in length, of the volcanic massive of Ankaratra, and publishes the results of the absolute measurements made with a Mascart magnetograph at Tananarive, in the year ending April, 1903. The declination has diminished by 11′, the inclination by 1′ 45″, the horizontal component by 0·00033. H. B.

1805. *Regulation of Ships' Compasses.* **H. Meldau.** (Phys. Zeitschr. 4. pp. 479–480, June 1, 1903.)—The author, in continuation of his investigations into the compensation of ships' compasses [see Abstract No. 1183 (1904)] now compares the value of a massive iron cylinder, as suggested by W. Thomson, with a thinner-walled cylinder. L. H. W.

1806. *Magnetic Declination.* **G. Agamennone.** (Accad. Lincei, Atti, 12. pp. 425–428, June 6, 1903.)—Historical account of a sudden change in the magnetic declination (from 3½° W. to 5° W.) which took place at Rome in October, 1680, with effect persistent thereafter. A. D.

1807. *Variations of Horizontal Component of Magnetic Intensity with Height above Sea-level.* **A. Pochettino.** (Accad. Lincei, Atti, 13. pp. 96–101, Jan. 17, 1904.)—These variations are greater than Gauss's theory would indicate. They are a diminution of 0·0004 to 0·0005 absolute units per thousand metres vertical ascent, instead of 0·0001. This is in harmony with the result of Schmidt (Aër. Mitth. 1901, p. 138) that the terrestrial magnetic field is in part due to causes external to the earth. A. D.

1808. *Nervous System and Hertzian Waves.* **G. Gallerani.** (Elettricità, Milan, 23. pp. 58–61, Jan. 29, and pp. 86–88, Feb. 12, 1904.)—Shows that nerve-muscle preparations are extremely sensitive indicators for Hertzian waves, being even excited to tetanic contractions, and the muscle being sensitive even after the nerve is exhausted. The sensitiveness is so high as to explain sensitiveness to distant weather conditions and to make the investigator think favourably of possibilities of telepathy. A. D.

1809. *Magnetic Storm of October* 31, 1903. **C. Carpini.** (Elettricista, Rome, 13. pp. 3–4, Jan. 1, 1904.)—Compilation of facts concerning this storm; the relation of sun-spots and protuberances is discussed; a similar event is predicted for the year 1914–1915. A. D.

1810. *Cicatrisation of a Rodent Ulcer after Electrolytic Introduction of the Zinc Ion.* **S. Leduc.** (Revue Int. d'Électrothérapie, 13. pp. 213–214, Dec., 1903, and Jan., 1904.)—The disease, which was of 5 years' standing and of considerable extent, had resisted all surgical treatment. The positive electrode, consisting of a pad of absorbent wool soaked in a 1 per cent. solution of ZnCl, was applied, and a current of 8 milliamperes passed for 12 min. This treatment was adopted on one occasion only, and 10 days after cicatrisation had occurred and appeared permanent. H. W. P. Y.

1811. *Galvanofaradisation in the Treatment of Mucous Colitis.* **H. Bordier.** (Archives d'Él. Médicale, 12. pp. 88–93, Feb. 10, 1904.)—The author has obtained excellent results in the treatment of mucous colitis and habitual constipation by galvanofaradisation. He uses an induction coil wound with fine wire. The intensity of the galvanic current employed has a minimum of 70 milliamperes, and is frequently raised to 100, 120, or even 150 milliamperes. The positive electrode, which is placed on the abdominal wall, is of aluminium covered with a thick layer of felt, and has an area of 550 sq. cm. The negative electrode is slightly larger. The treatment lasts at least a month with séances of 20 to 40 min. duration. H. W. P. Y.

1812. *Influence of Incandescent Substances on Ionisation.* **F. L. Tufts.** (Phys. Zeitschr. 5. pp. 158–159, March 15, 1904. Translated from the English.)—The experiments of the author show that when a platinum plate is introduced into a flame which forms part of an electric circuit there is a great fall in the current strength corresponding to an increase of the kathodic resistance, this resistance increasing with the e.m.f. The results are contradictory to Wilson's. [See Abstract No. 1722 (1899).] G. E. A.

1813. *Demonstration of Magnetostriction.* **H. Nagaoka.** (Nature, 69. pp. 487–488, March 24, 1904.)—The magnetic change in length and Wiedemann effect are shown by capillary ripples formed on mercury. Hang an iron wire vertically in the axis of a long solenoid having copper ends soldered at each end. At the lower end of the wire solder a cross wire carrying a plate which dips in mercury. On passing an alternating current in the coil the surface of mercury becomes rippled, and if a glass plate be placed at 45° over the mercury and a beam of light sent to it the ripples may be projected on the ceiling. If the wire be horizontal and itself carry a current, the Wiedemann effect can be shown by the same means. Nickel shows the same effects in greater degree. P. E. S.

1814. *Portable Torsion Magnetometer.* **F. Kohlrausch** and **L. Holborn.** (Ann. d. Physik, 13. 5. pp. 1054–1059, April, 1904. Communication from the Physikalisch-Technische Reichsanstalt.)—The authors describe a more compact and portable form of magnetometer which has all the advantages possessed by that described in Abstract No. 1243 (1903).

1815. *Electric Conduction in Mercury Vapour.* **A. P. Wills.** (Phys. Rev. 18. pp. 319–320, April, 1904. Abstract of paper presented at the meeting of the American Physical Society, Feb. 27, 1900.)—From experiment a value of the electric intensity (in a mercury lamp) in terms of the steady current, the vapour pressure and the diameter of the tube in which the vapour is, is obtained. The expression is linear, and involves four constants which suddenly change their values at a special pressure and afterwards remain constant. P. E. S.

CHEMICAL PHYSICS AND ELECTRO-CHEMISTRY.

1816. *The Supposed Spontaneous Alteration in the Weight of Radium Bromide.* **E. Dorn.** (Phys. Zeitschr. 4. pp. 580–581, July 1, 1903.)—Thirty milligrammes of radium bromide were sealed in a tube of alkali-free glass, suspended by means of a platinum wire and counterpoised against a similar tube containing sand. Each tube weighed a little more than 1 gm., and the difference in weight was about ⅓ mgm. A series of five observations during the winter, December 28 to January 4, gave the difference as—

$$-0{\cdot}3824 \pm 0{\cdot}0013 \text{ mgm.},$$

whilst three observations in the spring (March 25–28) gave the difference as $-0{\cdot}3833 \pm 0{\cdot}0004$ mgm., and seven observations from March 25 to April 10 gave $-0{\cdot}3820 \pm 0{\cdot}0011$ mgm. These observations definitely exclude a loss of weight of more than 0·001 mgm. in three months. Heydweiller found a loss in weight of 0·02 mgm. per day on 5,000 mgm., but his material was ten times less active. If there had been a proportionate loss in the experiments now described there would have been a decrease in weight of 0·11 mgm.

T. M. L.

1817. *Atomic Weights of Oxygen and Hydrogen and the Probable Value of Atomic Ratios.* **P. A. Guye** and **E. Mallet.** (Comptes Rendus, 138. pp. 1034–1037, April 25, 1904.)—From a systematic study of the probable value of the ratio between atomic weights the authors conclude that, in many cases, the value of this ratio may be taken as the arithmetic mean corrected by the method of Vallier [see Abstract No. 649 (1899)]. Applying this method of correction to the values of the ratio O : H obtained by Morley in 1895 by measurements of (1) $O : H_2$, (2) $H_2O : H_2$, and (3) the densities of oxygen and hydrogen and the volume ratio in which they combine, the following numbers are obtained for the atomic weight of oxygen :—

	Morley.	Arithmetic Means.	Corrected Means.
Method (1)	15·8792	15·8791	15·8789
Method (2)	15·8786	15·8785	15·8786
Method (3)	15·879	15·8784	15·8786
Extreme differences, absolute ...	0·0006	0·0007	0·0003
Extreme differences, relative ...	1:26,000	1:23,000	1:53,000

The final value may hence be taken as O = 15·8787 for H = 1, or H = 1·00764 for O = 16, the difference for the most discordant of the corrected means being only 1 in 80,000.

T. H. P.

1818. *Colloidal Silver.* **Hanriot.** (Comptes Rendus, 137. pp. 122–124, July 13, 1903.)—To trace the origin of the hydrogen [see Abstract No. 1548 (1904)] the author prepared a colloidal silver containing silica in place of gelatine. This was made by adding formaldehyde and silver nitrate to a solution of potassium silicate. By adding acetic acid short of excess a gelatinous magma of silico-argolic acid mixed with silica was obtained. The free silica was removed by washing with potassium carbonate. The figures for the analysis of the purified substance were not concordant, however; one sample contained silica, 66·93 per cent., and silver, 14·43 per cent., besides appreciable amounts of alumina, oxide of iron, and caustic potash. It is slowly attacked by dilute acids and decomposed by concentrated caustic potash. When heated in vacuo 2 gm. gave 4·1 c.cm. CO_2 and 4·5 c.cm. H_2, corresponding to $Ag_{13}H_2$. The author concludes from all his investigations that the albuminoid matter, the oxide of iron, or the silica form an integral part of the molecule, and are not to be regarded as impurities. Heated in a vacuum they all give off carbon dioxide and hydrogen. F. S

1819. *Intramolecular Changes extending over Prolonged Periods of Time.* **R. J. Friswell.** (Chem. News, 89. pp. 196–197, April 22, and pp. 207–209, April 29, 1904.)—In order to account for the change of diazobenzeneanilide into aminoazobenzene, V. Meyer in 1881 proposed the theory of the "labile" or movable hydrogen atom. From a further study of this change the author concludes that Meyer's hydrogen atom is not the only atom endowed with variability. Diazobenzeneanilide is, in reality, an aniline salt, and in the absence of an acid will continue to exist, but if an acid "strain" is thrown on to it, it will be completely converted into a basic body, provided the acid is one with a sufficiently powerful acid character to be able to break up the whole mass into a salt of aniline and a diazobenzene salt and so exclude the latter from all participation in the reaction. The author suggests that the character of a chemical compound is a function of the strains mutually exerted between it and the reagents made use of to ascertain its constitution; for instance, a compound showing but feeble basic properties to a weak acid may, and does, develop strongly basic properties to a strong acid and *vice versâ.* T. H. P.

1820. *Life-History of Radium.* **J. Joly.** (Nature, 70. p. 30, May 12, 1904.)—The average life of the uranium atom is calculated to be 10^{10} years—a period one hundred times greater than the period allowed for the development of the geological strata. T. M. L.

1821. *Life-History of Radium.* **W. C. D. Whetham.** (Nature, 70. p. 5, May 5, 1904.)—The view that uranium is the parent-substance of radium was advanced by Rutherford and Soddy on the ground that it is one of the few elements having a higher atomic weight, that it is the main constituent of radium ores, and that the proportion of radium in good pitchblende corresponds roughly with the ratio of activity of radium and uranium. An examination of a number of specimens of uranium salts purchased from seventeen to twenty-five years ago showed that these all contained a larger proportion of radium than the more modern specimens. This result is in accordance with the theory enunciated by Rutherford and Soddy, but may easily be due to modified methods of preparation. **F. Soddy.** (Nature, 70. p. 30, May 12, 1904.)—A kilogramme of uranium nitrate was purified until the proportion of radium present was less than 10^{-13} gm. as tested by the maximum amount of accumulated emanation. At the end of twelve months the amount of accumulated radium was certainly less than 10^{-11} gm. instead of the 5×10^{-7} gm. calculated from the ratio of the radio-activities of radium and uranium. The quantity of radium produced was therefore less than one ten-thousandth part of the theoretical quantity, and this result practically settles, in a negative sense, the question of the production of radium directly from uranium. It is, of course, possible that intermediate substances might exist, and that radium would only be produced at a later stage, but there is no experimental evidence in support of this view. T. M. L

1822. *The Source of Radium.* **J. Joly.** (Nature, 70. p. 80, May 26, 1904.) **W. Ramsay.** (Nature, 78. p. 80, May 26, 1904.)—Joly suggests that radium may not be derived purely as a disintegration product but as an atomic combination of radio-active products with some of the elements present in pitchblende. Thus radium would represent the synthesis of an element, not its decomposition, and the new atom not being very stable would be short-lived. Hence its radio-activity. The genesis of radium might be sought in molecular intermixtures of the radio-active elements with the various bodies conspicuously present in pitchblende. Ramsay considers that a more promising field of research appears to be to try to ascertain whether the immense amount of energy evolved in various forms during the disintegration of the radium emanation may not be able to cause chemical change of a constructive nature; for example, to change bromine into iodine. An attempt has been made to see if this was the case, but without a positive result. J. J. S.

1823. *Uranium and Radium.* **B. B. Boltwood.** (Nature, 70. p. 80, May 26, 1904.)—In the course of an investigation on uranium-bearing minerals, the author has found a close agreement between the amount of uranium and the amount of radium present in those minerals which have been examined. J. J. S.

1824. *Influence of Light on the Action of Hydrochloric Acid on Platinum and Gold.* **Berthelot.** (Comptes Rendus, 138. pp. 1297–1299, May 30, 1904.)—In the dark, fuming hydrochloric acid has no action on platinum or gold, but after exposure to light for four months in two-litre flasks full of air, very distinct quantities of both metals are dissolved, the presence of an oxidisable chloride, such as manganous chloride, increasing the solvent action in each case. Thus 200 c.cm. of acid dissolve 0·005 gm.Pt and 0·018 gm.Au when exposed to light; and 0·0119 gm.Pt and 0·026 gm.Au in the light with addition of 1 gm. manganous chloride. The manganese salt also causes a slight action on gold even in darkness, and its effects are attributed to the trace of chlorine produced by the action upon it of fuming hydrochloric acid. W. H. Sr.

1825. *On a Compound of Two Substances which Combine on Elevation of Temperature and then Separate below —79°.* **D. Gernez.** (Comptes Rendus, 137. pp. 255–257, July 27, 1903.)—The author has shown [see Abstracts Nos. 1499 (1903), and 1863 (1904)], that from many solvents mercuric iodide is deposited in the metastable yellow form at all temperatures down to —192°. When acetone is used, certain peculiarities are observed. A saturated solution of mercuric iodide in acetone was prepared in a capillary tube of 2 mm. diam. at about 56°, and then placed in liquid air. On removing it from this the contents of the tube are seen to be solid and of a white colour; on the contents becoming somewhat warmed by the surrounding air, their colour changes to lemon-yellow. When the temperature has risen somewhat, the solid fuses, but shortly afterwards begins to resolidify, and the solidification begins at the parts where the temperature is rising most rapidly. If, after it has become filled with the solid, the tube is immersed in a mixture of carbon-dioxide snow and acetone at a temperature of —79°, the solid mass shrinks in bulk, and after an hour occupies only 1/10 of its original volume; and after a longer time it passes spontaneously into red mercuric iodide. The author explains the phenomena as follows: On cooling the solution by liquid air, the acetone solidifies, retaining the mercuric iodide in solution. When this is heated to —94·9°, the acetone melts and forms a solid compound with the mercuric iodide. This compound persists unaltered within a small range of temperature. Below —79° it gradually breaks up, and the yellow mercuric iodide is deposited. A. F.

1826. *Solubility of Gases in Liquids.* **L. Cassuto.** (N. Cimento, 6. pp. 5–20, July and Aug., 1903.)—Employing a special form of absorptiometer, the author has determined the solubility of hydrogen, oxygen, nitrogen, and carbon monoxide in water at pressures up to 10 atmospheres, and at different temperatures. He concludes that at pressures of about 1 atmosphere the coefficient of solubility is practically constant, but that with largely increased pressures it decreases, the divergence from Henry's law being greater as the pressure is raised. The results of Bohr and Boch on the diminution of solubility with increase of temperature are confirmed. W. H. Si.

1827. *Solubility of Gold in Some Oxidising Agents.* **V. Lenher.** (Amer. Chem. Soc., Journ. 26. pp. 550–554, 1904.)—The author points out that gold is readily attacked in many reactions in which oxygen is formed, especially when heated. When heated with sulphuric or phosphoric, nitric or telluric acids, it goes into solution, as is also the case when heated with the higher oxides of Pb, Mn, and Cr or nickelic oxide. No action takes place with gaseous oxygen and acid, though anode oxygen attacks gold in presence of strong sulphuric acid. Using an anode of sheet gold and a platinum crucible as kathode, when the acid was hot the gold was readily dissolved and then deposited with a current of 0·3–0·4 amp. With phosphoric acid or dilute sulphuric acid or solutions of neutral salts no solution takes place, but an incrustation of gold is left on the anode. With caustic alkalies a little gold goes into solution. L. H. W.

1828. *Flocculation Phenomena.* **M. Neisser** and **U. Friedemann.** (Chem. Centralblatt, 1. pp. 1387–1388, 1904.)—Experiments with aluminium sulphate, ferric chloride, ferric nitrate, colloidal ferric hydroxide, arsenic trisulphide, and ferric hydroxide showed that when colloids and suspensions, carrying opposite electric charges, are brought together in certain proportions they are simultaneously separated in the form of flocks. Albuminoid colloids such as gelatine, serum, and bacteria, protect negatively charged suspensions and colloids from the action of those precipitants by which they themselves are not precipitated. The latter colloids, though themselves not capable of causing flocculation, acquire that property when a small quantity of a salt, incapable of itself producing this effect, is added. The albuminous colloids may be regarded as possessing both electro-positive and electronegative properties. A small quantity of added salt converts the amphoteric colloid into a singly charged one behaving like the metallic colloids.

L. H. W.

1829. *Viscosity of Aqueous Solutions.* **C. E. Fawsitt.** (Roy. Philosophical Soc. of Glasgow, Proc. pp. 3–7, 1904. Abstract.)—With solutions of nonelectrolytes, $\eta_x = A^x$, where η_x is the viscosity of a solution of concentration x and A is a constant; the author shows that this relation holds well in the case of acetamide. With an electrolyte of which z represents the total concentration and a the fraction ionised, the equation becomes $\eta = A^{z(1-a)}(B.C)^{a \cdot z}$, where A, B, and C are constants for the electrolyte and its two ions respectively. The viscosity constants for the ions, determined in this way, are in many cases less than unity, and the negative viscosity found in some electrolytes is due to the negative viscosity of one or both of the ions. The viscosity constants and migration velocities of the ions stand approximately in inverse proportion. The formula $\eta = A^x B^y$ gives the viscosity of a mixture of two substances which do not combine chemically; if, however, chemical action takes place, the value found for η is different from the calculated one. Such a change in viscosity may be used as evidence of salt formation, when this is not shown by chemical examination. The following are the values obtained for the viscosity constants of solutions of three amides at 25°:—

Carbamide	1·045
Methylcarbamide	1·142
Ethylcarbamide	1·238

It will be seen that the difference between successive numbers is constant, showing that, to some extent, the viscosity of solutions is an additive property. On adding a non-electrolyte to an electrolyte, the way in which the conductivity decreases is exactly parallel with the manner in which the viscosity increases; the temperature coefficients of viscosity and electrical conductivity are practically identical. The diminution produced in the velocity of the reaction, $COS + H_2O = CO_2 + H_2S$, by the addition of certain salts, is accompanied by an increase in viscosity, but there is no proportionality between the amounts of the two changes. T. H. P.

1830. *Inversion of Cane Sugar under the Influence of Platinum Metals.* **F. Plzák and B. Hušek.** (Zeitschr. Phys. Chem. 47. pp. 733–739, April 11, 1904. Also, Sitzungsberichte der böhmischen Akad. in Prag.)—Since it was found by Šulc [Abstract No. 1520 (1900)] that palladium retarded the inversion of cane sugar by dilute hydrochloric and sulphuric acids, the authors have taken up the investigation of this point. With the ordinary commercial metal in powder form, they found a very great retardation of the inversion. When, however, the palladium was washed with hydrochloric acid, it was found that the retardation was not nearly so great; and from this they concluded that the retardation was due to the presence of palladium oxide. Pure palladium was then employed, prepared by precipitating a solution of palladium in aqua regia with potassium iodide, washing and igniting the latter in a current of hydrogen. The palladium was then ignited in the air. This palladium had no special influence on the inversion with hydrochloric acid. Slight retardation was shown to be due probably to the presence of foreign metals, chiefly zinc. When perfectly pure palladium is employed and only an aqueous, not acid, solution of cane sugar, acceleration of inversion was observed. Experiments with platinum showed that the latter has a much greater accelerating effect; but the same retardation is observed with platinum as with palladium when the metal is ignited in the air. Iridium has a similar action, but less than palladium. The acceleration when no acid is present seems due to the presence of oxide of the metal, since palladium became more active the longer it was ignited in the air. A. F.

1831. *Chemical Equilibrium between Hydroferrocyanic and Hydroferricyanic Acids.* **M. Prud'homme.** (Chem. News, 89. p. 199, April 22, 1904.)—Solutions of hydroferricyanic acid yield a blue colouration with filter paper soaked in guaiacum tincture, so that the latter may be used as an indicator to determine the end-point in the titration of ferrocyanides with chromic acid solution. The change is reversible and the liquid acquires the power of turning guaiacum blue at the equilibrium-point. On continuing the addition of the chromic acid solution until the liquid no longer gives the blue colouration with filter paper (which contains chlorine, not removed after bleaching the pulp), the transformation of hydroferrocyanic acid into hydroferricyanic acid will be complete. On measuring the volumes of chromic acid solution required to produce equilibrium and complete transformation respectively, it is found that the relative velocities of the oxidising and de-oxidising actions are as 10 : 1. A process is described for estimating soluble ferrocyanides by titrating with chromic acid solution. T. H. P.

1832. *Equilibrium between Benzene, Acetic Acid, and Water.* **A. T. Lincoln.** (Journ. Phys. Chem. 8. pp. 248–256, May, 1904.)—Contrary to Waddell, the author finds that the physical reaction between benzene, acetic acid, and water, conforms to the law of mass action, and that between the limits of temperature studied (25° to 35° C.), variation in temperature does not affect the value of the exponential factor in the mass law equations. The point of equilibrium is considered to be reached when sufficient water has been added to just produce a decided opalescence, and Waddell is shown to have been wrong in selecting the same degree of clouding as the proper point, thus explaining the opposite results he obtained. W. H. Si.

1833. *Properties of Solutions in Dimorphous Solvents.* **G. Bruni** and **A. Callegari.** (Accad. Lincei, Atti, 13. pp. 481–489, May, 1904.)—The authors develop the phase theory as applied to binary systems, and show that it may be used to determine whether a body is enantiotropic or monotropic. Thus if, by dissolving a substance in a dimorphous solvent, the melting-points of the two phases are brought nearer together, the solvent is enantiotropic, while if their difference is increased it is monotropic. By sufficiently concentrating the solution, an enantiotropic body may become monotropic. Further, given the temperatures of fusion of the two modifications and their temperature of transformation, if the molecular depression and heat of fusion for one phase are known, those for the other may be readily calculated. Experiments with solutions of naphthalene and diphenyl in *o*-nitrobenzaldehyde, and of camphor and benzolmenthol in methylene iodide verify their theoretical deductions, the figures obtained for methylene iodide confirming those obtained by Tammann and Hollmann. Incidentally the velocity of crystallisation for *o*-nitrobenzaldehyde is shown to be higher than that of any other organic substance. W. H. Si.

1834. *Pure Colloidal Silver.* **A. Chassevant.** (Chem. News, 89. p. 218, May 6, 1904. Bull. Soc. Chim. Series 3, vol. 31, No. 1.)—This was prepared according to Schneider's method (Ber. 25, p. 1281) and purified several times by dissolving in water and reprecipitating with 95 per cent. alcohol. Pure aqueous solutions of colloidal silver have no tendency to deposit the black insoluble form, and if the solution is free from electrolytes it can be kept for several weeks. After two purifications a solution was obtained containing 0·8 per cent. solid matter composed of 96·6 per cent. metallic silver. On evaporation in vacuo metallic silver is produced, but if an organic colloid is present, solid colloidal silver can be obtained. Carey Lea's opinion is thus confirmed (Zeitschr. Anorg. Chem. 14. p. 341). [See also Abstracts Nos. 1548 and 1550 (1904).] F. S.

1835. *Solubility of Silicon in Silver, and Production of a Crystalline Modification of Silicon Soluble in Hydrofluoric Acid.* **H. Moissan** and **F. Siemens.** (Comptes Rendus, 138. pp. 1299–1303, May 30, 1904.)—Continuing their experiments on the solution of silicon in different metals [see Abstract No. 1228 (1904)], the authors have determined its solubility in silver at various temperatures. It is much more soluble than in lead or zinc, solution commencing almost from the melting-point of silver. A certain proportion of the crystalline silicon obtained by dissolving the silver in nitric acid is found in all cases to be soluble in hydrofluoric acid, the amount diminishing with increase of temperature, and the results obtained being as follows :—

Temperature °C.	970	1150	1250	1470
Per cent. of silicon dissolved	9·22	14·89	19·26	41·46
Per cent. of silicon soluble in hydrofluoric acid	5·35	4·02	3·66	6·63

This new form of silicon crystallises in yellow, transparent plates, of about the same density as the other two varieties. Heated to 1,200° in vacuo, no hydrogen is evolved, and sulphuric acid produces no nitric vapours, the only impurities found being a small quantity of iron and a trace of carbon silicide. The best yield is obtained with silver solutions of about 4 per cent., and the temperature to which the silver is subjected has no effect on the result.

W. H. Si.

1836. *Quantitative Electrolytic Separation of Metals.* **P. Denso.** (Zeitschr. Elektrochem. 9. pp. 463–470, June 4, 1903. Elektrochem. Lab. der techn. Hochschule, Dresden.)—The decomposition potential of copper sulphate in normal solution is 1·48 volts, while the values in the case of the sulphates of zinc, cadmium, and nickel are 2·54, 2·24, and 2·99 respectively. Copper can therefore be separated from these metals by using an e.m.f. which does not exceed 2 volts; this can be most conveniently done by using one accumulator. According to theory the current strength can be increased by stirring the electrolyte, which may be done by means of a movable anode, by platinising the anode and by increasing the concentration of the acid; experiments made to investigate each of these factors were found to agree with the theory. 0·25 gm. of copper can be completely deposited on a wire gauze electrode in 3–3½ hours by the use of a single accumulator; the deposit is pure and adherent. Since there is no nitric acid present in the electrolyte, but only sulphuric acid, none of the deposit is dissolved when the kathode is taken out of the bath and washed. If a voltage of 2·6 is used cadmium can be completely deposited from an acid solution, as long as the sulphuric acid is not appreciably stronger than 1/5 normal. If the voltage is not greater than 2·6 cadmium can be deposited free from zinc from a solution containing both metals. In order to separate nickel from copper the latter metal is deposited with an e.m.f. of 2 volts, and then the electrolyte almost completely neutralised with sodium carbonate; the nickel is then deposited by means of two accumulators, using a variable resistance in the circuit. With 0·5 amp. or less, nickel can be completely deposited overnight. Zinc can be completely separated from cadmium, even when present in small quantities, by deposit-ing the cadmium by means of 2·6 volts from a 1/10 normal acid solution, and then using 3 volts to deposit the zinc from a potassium cyanide solution.

T. S. P.

1837. *Anode Potentials during the Formation of Lead Carbonate and Lead Chromate.* **G. Just.** (Zeitschr. Elektrochem. 9. pp. 547–549, July 2, 1903. Physik. chem. Inst. d. Techn. Hochschule, Karlsruhe.)—Lead plates were immersed in a 1·5 per cent. solution of sodium chlorate, afterwards increasing amounts of sodium carbonate up to 1·5 per cent. were added. A current of 1·7 amps. was passed between the plates and the anode potential balanced against a normal cadmium cell. With small concentrations of sodium carbonate, the commencing potential corresponds to that of pure lead. With stronger concentrations, the anode potential increases slowly at first and then more rapidly; finally oxygen and lead peroxide appear, the potential being that of the latter. Analogous results were obtained with sodium chromate in place of the carbonate. The author found that the anode potential was proportional to the current density. He noticed that when lead plates were electrolysed in sodium carbonate there was a gradual increase in the deposit of lead carbonate on the anode. He uses this to explain his results. F. S.

1838. *Carbon Electrodes in Fused Electrolytes.* **J. Härdén.** (Phys. Zeitschr. 4. pp. 552–553, July 15, 1903.)—A large rod of pure carbon was heated strongly and cut in two. The two pieces were then pressed together in a frame, which was not in metallic contact with them. The one pair of ends were connected to a fairly high resistance galvanometer. On heating the other ends in a blowpipe, no e.m.f. was noticeable. On dipping them into melted calcium chloride, a perceptible current passed. The e.m.f. increased to 0·15 volt with increasing temperature up to 650° C., and afterwards fell. With lead nitrate 0·35 volt was obtained at 360° C.; a fused mixture of sodium and potassium carbonates gave 0·04 volt. Uneven heating greatly affected the potential, the rod at the lower temperature usually having the higher e.m.f. The electrodes were afterwards found to be unequally attacked.

F. S.

1839. *Passive State of Nickel.* **M. le Blanc and M. G. Levi.** (Boltzmann Festschrift, 183–195, 1904. Chem. Centralblatt, 1. pp. 1396–1397, 1904.)—In electrolytes containing haloid salts or cyanides and in sulphuric acid, nickel goes into solution quantitatively at ordinary temperatures and with a current density of 0·5 amp. per sq. dcm. In other solutions it is passive, though the behaviour in sodium acetate solution depends upon previous treatment and tends towards passivity. Increase of temperature favours the change to the active condition, although nickel is passive in potassium hydroxide solution even at 80° and partly so in ammonium oxalate and sodium acetate solutions. Increase of current density increases the passivity, the strength of electrolyte being without influence. In sodium carbonate and potassium hydroxide solutions this passivity may be due to an insoluble film, but in other solutions appears to depend on the reaction velocity. A small amount of NaCl, added to the solution in which the nickel becomes passive, is sufficient to increase the rate of formation of ions to that necessary for quantitative solution of the nickel. Sulphuric acid is less effective, and acetone or sugar without any effect.

L. H. W.

1840. *Polarisation of Mercury Electrodes.* **E. Rothé.** (Annal. Chim. Phys. 1. pp. 433–495, April, 1904.)—For the polarisable electrode the author uses, in this case, a small mercury surface in a glass tube. The polarisation curves agree essentially with those obtained for platinum, but there are small differences conditioned by the peculiar chemical character of mercury—ready salt formation, rapid diffusion of the gases in the liquid metal and the slight solubility of the hydrogen. Details are given of the anodic polarisation when dilute sulphuric or hydrochloric acid is used as electrolyte. Between 0·35 and 0·63 volt phenomena are observed similar to those appearing with platinum electrodes at about 1 volt. The curves of kathode polarisation show three distinct parts depending on the diffusion and absorption. When diffusion begins, the current remains constant for a few thousandths of a second, and then suddenly falls, owing to the rapid saturation of the mercury with the gas. Comparison with the curves for platinum and palladium shows that the curve becomes flatter as the absorptive power of the metal increases. Like platinum electrodes, those of mercury do not return to their original condition immediately after the polarisation ceases. After repeated charging and discharging, a limiting state is finally reached, which is evidenced by the complete coincidence of the curves obtained, and depends on the nature of the treatment. The author assumes the formation of real chemical compounds between the electrode and the products of electrolysis, since the double-layer theory yields insufficient explanation of the phenomena. The author's results confirm Bouty's conception of a voltameter as a peculiar combination of condenser and accumulator. [See also Abstracts Nos. 1871 and 1872 (1904).] All three papers are dealt with in Soc. Franç. Phys. Bull. pp. 99–136, 1904.

T. H. P.

1841. *Electrolytic Preparation of Azo-Dyes.* **W. Löb.** (Zeitschr. Elektrochem. 10. pp. 237–238, April 8, 1904. Communicated from the Bonner Chem. Universitätsinstitut.)—Some years ago [see Abstract No. 1551 (1899)], the author described the preparations of mixed azo-compounds by the common electrolytic reduction of several nitro-compounds. The process failing sometimes, he has tried the anodic preparation of oxy-azo dyes. In principle the new process is that of Griess, diazotising of amines, followed by coupling with phenols. But here the amine, nitrite, and coupling agent are simultaneously electrolysed with an insoluble anode (Pt) in neutral or even alkaline—instead of acid—solution. To prepare dianisidine blue, *e.g.*, dianisidine, β-naphthol, sodium nitrite, and water are brought into the anode compartment. Orange II., congo, chrysamine *g*, and rocceline have also been made; particulars are to follow.

H. B.

1842. *Ion Action.* **A. S. Loevenhart** and **J. H. Kastle.** (Science, 19. pp. 630–632, April 15, 1904.)—The authors dispute the conclusion drawn by many investigators that the differences observed in the physiological action of a series of analogous salts possessing, for instance, a common anion, are to be attributed to a specific action of the kathions on the tissue. Thus, for instance, it has been recently stated by Neilson and Brown [see Abstract No. 1867 (1904)], that, in the action of salts on the catalytic decomposition of hydrogen peroxide by platinum black, the kathion has usually an inhibiting or depressing effect and the anion an accelerating effect. The authors find, on the other hand, that the inhibitory action of certain salts on the decomposition of hydrogen peroxide by various metals is due to the formation of a thin insoluble film over the surface of the metal by the action of the salt on the metal. So that the catalysis by a given metal is inhibited by those salts whose constituent acid yields an insoluble salt with the catalyser. Thus, the catalysing action of silver is inhibited by chlorides, bromides, iodides, or cyanides, but not by fluorides; soluble haloid salts exert the same influence on the catalysing action of thallium as they do in the case of silver, but cyanides have here no inhibiting effect, as thallium cyanide is soluble. Using freshly cut shavings of thallium, the formation of the film on treatment with potassium bromide can be directly observed. The action of accelerators of the catalysis of hydrogen peroxide is not yet quite clear, but must depend more on the chemical behaviour of each individual substance than the mere fact that it is in the ionic condition. In general, the sodium salts of organic acids hasten the catalysis, and it is probable that the hydrolysis of these salts is one factor in this action, since the alkalies promote the decomposition of hydrogen peroxide and increase its instability. T. H. P.

1843. *Electrolytic Oxidation of Sulphites, and Electro-chemical Formation of Dithionate.* **A. Friessner.** (Zeitschr. Elektrochem. 10. pp. 265–289, April 22, 1904. Elektrochem. Lab. der techn. Hochschule, Dresden.)—In the electrolysis of neutral and alkaline sodium sulphite solutions no reduction takes place at the kathode, and, with medium current density, no evolution of oxygen at the anode. The oxygen is used for the oxidation of the sulphite to sulphate, which, under certain conditions, may be accompanied by dithionate, formed according to the equation—

$$2SO_3'' + 2OH' + 2H^{\cdot} + 2(+) = S_2O_6' + 2H_2O$$

From this it is seen that the alkali simultaneously appearing at the kathode must remain in the electrolyte. In bisulphite solutions, dithionate may be obtained under certain conditions, but sulphate is exclusively formed at the anode. In the electrolysis of bisulphite without a diaphragm, sulphate is formed at the anode, hydrosulphite at the kathode, and also thiosulphate, probably, at the kathode. At the ordinary temperature the formation of dithionate occurs at an anode potential greater than that required for the production of sulphate. The potential necessary for dithionate formation is best obtained by preliminary anodic polarisation of platinum anodes, after which a moderate current density is sufficient; owing to formation of acid at the anode, high current densities may diminish the yield of dithionate to zero. With smooth anodes, even after ignition, dithionate is always formed, whilst with platinised anodes after kathodic or chemical depolarisation, no dithionate appears at the ordinary temperature. A rise in temperature favours formation of dithionate under conditions which yield only sulphate at the ordinary temperature, while with smooth platinum anodes dithionate can be obtained at temperatures below 0°. The concentration and alkalinity of the sulphite solution have no appreciable influence on the yield of dithionate. Pure solutions of the latter or of free dithionic acid undergo no alteration at the kathode, while at the anode oxidation to sulphate takes place, but never to a greater extent than 3 per cent. The author is of opinion that, to explain the different degrees to which smooth and platinised platinum electrodes undergo polarisation, not only the physical absorption but also the oxidisability of the platinum, especially of the platinum black, must be taken into account. Comparison is made between the mechanism of the chemical and electrolytic formation of dithionate, percarbonate and persulphate. In all three reactions the hydroxyl ions of the water are first discharged. The dithionate requires the lowest, and the persulphate the highest potential, as may also be concluded from the chemical behaviour of the three compounds. From the purely chemical method of formation of dithionate and also from the electrolytic method studied by the author, it follows that only the SO_3 ions, and not the HSO_3 ions, are capable of yielding dithionate. T. H. P.

1844. *Electrolytic Dissolution of Platinum in Cyanide Baths. Preparation of Platinocyanides.* **A. Brochet** and **J. Petit.** (Comptes Rendus, 138. pp. 1095–1097, May 2, 1904.)—In continuation of their experiments on the electrolytic dissolution of anodes [see Abstracts Nos. 1234 and 1240 (1904)], the authors find that, while platinum anodes are indestructible in solutions of potassium cyanide, the metal is readily attacked by alternating currents of frequency 42 and a current density of from 20 to 80 amps. per sq. dcm. From 0·4 to 0·6 gm. Pt are dissolved per amp.-hour, which corresponds to a current efficiency of 10 or 15 per cent. In solutions of barium cyanide, the efficiency does not exceed 11 per cent., and the reaction—

$$Pt + 2Ba(CN)_2 + 2H_2O = Pt(CN)_4Ba + Ba(OH)_2 + H_2$$

further yields a little carbon dioxide, ammonia, and nitrate. Yet the method is convenient for the preparation of barium platinocyanide. Iron and cobalt behave like platinum; iron is more readily dissolved in hot solutions, cobalt by high current-density, which has little influence in the case of Pt and Fe. H. B.

REFERENCES.

1845. *Liquid Cells.* **Berthelot.** (Comptes Rendus, 136. pp. 1357–1373, June 8; 1497–1505, June 22; 1601–1608, June 29; 137. pp. 285–290, Aug. 3, and pp. 421–430, Aug. 24, 1903.)—The author states the law, and gives experimental verification, that $E = e_1 + e_2$, in which E is the e.m.f. of a cell A + B (*i.e.*, whose liquids are A and B) and e_1, e_2 are the e.m.f.'s of the two cells A + AB and B + AB respectively, AB being a mixture of A and B. In the second paper the author considers the e.m.f. at the junction of the liquids as equivalent to the heat evolved by the combination or mixture. He also discusses the variation of e.m.f. due to change of electrodes and other causes. In the other papers various extensions of the subject are dealt with. The papers are really a continuation of those referred to in Abstract No. 935 (1904). W. R. C.

1846. *Action of Iodine on Thin Films of Copper.* **Houllevigue.** (Comptes Rendus, 137. pp. 47–50, July 6, 1903.)—Thin films of copper were deposited on glass, and the thickness determined by a modification of Fizeau's method. A small piece of iodine was placed near the film under a funnel. The iodide of copper can afterwards be removed by sodium thiosulphate. By working with successively thinner films, it was found that when the film was less than 40 $\mu\mu$ in thickness the iodine vapour did not act upon it. [See Abstract No. 468 (1903).] F. S.

1847. *Prussian Blue and Turnbull's Blue.* **P. Chrétien.** (Comptes Rendus, 137. pp. 191–194, July 20, 1903.)—The author gives the composition of a number of compounds containing iron and cyanogen, and especially of soluble and insoluble Prussian blue and of Turnbull's blue, and gives also some calorimetric measurements with regard to their heats of formation. A. F.

1848. *Catalytic Reactions of Metals; Accelerating and Retarding Influences.* **A. Trillat.** (Comptes Rendus, 137. pp. 187–189, July 20, 1903.)—A summary of the catalytic reactions furnished by spirals of platinum and copper, in formation of aldehydes by oxidation or dehydrogenation of alcohols, in condensation of alcohols and aldehydes to form methylal and acetal, and in the hydrolysis of these latter bodies and of esters. New copper is not suitable for the oxidation of alcohols, but should be heated so as to acquire a thin film of oxide. With use it increases in activity, becoming friable, and when powdered resembles spongy platinum in properties. The presence of palladium, platinum, or iron increases the activity of the copper, while lead, sulphur, or arsenic diminish it. W. H. Si.

1849. *Action of Emulsin on Salicin and Amygdalin.* **V. Henri** and **S. Lalou.** (Comptes Rendus, 136. pp. 1693–1694, June 29, 1903.)—The authors bring forward fresh proof for their formerly expressed opinion that the action of emulsin depends on the intermediate formation of an additive compound of the enzyme and the substance attacked, this compound afterwards breaking down again, yielding the enzyme. By means of polarimetric measurements they show that the rapidity with which emulsin acts on a mixture of salicin and amygdalin is less than the sum of the speeds with which the same quantity of emulsin acts on the two glucosides separately, but is greater than either of these speeds taken alone. The difference between the speed of action of the enzyme on the mixture of glucosides and the sum of the two separate speeds increases with the concentration of the glucosides, which is in accord with Henri's theory of enzyme action. T. H. P.

1850. *Conditions of Decomposition of Ammonium Nitrite.* **V. H. Veley.** (Chem. Soc., Journ. 83. and 84. pp. 736–749, July, 1903.)—The decomposition of ammonium nitrite into nitrogen and water proceeds according to the general law, $\log A/(A - x) = aT$, whether in the presence or absence of an accelerating agent. This decomposition is either impeded or stopped by ammonia liberated in the solution by the addition of metallic oxides; it is also similarly affected by amines and hydrazines and to a less degree by oximes. The decomposition is temporarily accelerated by amides of the paraffin series, but other amides are ineffective. Benzoic sulphinide, the only imide tried, produces a considerable acceleration. Solutions of ammonium nitrite, prepared from silver nitrite and ammonium chloride, do not become alkaline in the course of decomposition. T. H. P.

1851. *Development and Present State of Electrochemistry.* **A. Neuburger.** (Elektrochem. Zeitschr. 10. pp. 46–55, June; 177–183, Nov.; 208–212, Dec., 1903; and pp. 274–280, March, 1904.)—A review of the subject, historical and general.

1852. *Electrode Effects.* **H. M. Tory** and **H. T. Barnes.** (Amer. Electrochem. Soc., Trans. 3. pp. 95–100, 1903.)—The experiments were undertaken to determine the causes of the difficulty experienced in bringing plain platinum electrodes in pure water to zero potential. The irregularities were found to be due, not only to occluded gases, but also to the presence of gases in solution. The effects of air in solution on various metals employed as electrodes are given in tables.

G. W. de T.

1853. *Remarks on A. Guillemin's Note on Osmosis.* **A. Ponsot.** (Comptes Rendus, 138. pp. 356–358, Feb. 8, 1904.)—The author claims priority over Guillemin [see Abstract No. 709 (1904)] in relation to certain theoretical views on osmotic equilibrium, and as those views have been ignored by recent writers on this subject, he gives a short *résumé* of them. They consist in regarding the solvent-equilibrium across the semi-permeable wall as a species of *gaseous* equilibrium, and in so far as they are correct appear to coincide with Lewis's theory. F. G. D.

1854. *Free Ions in Aqueous Solutions.* **W. R. Whitney.** (Amer. Electrochem. Soc., Trans. 3. pp. 101–104, 1903.)—The author discusses Olsen's experiments [see Abstract No. 680 (1903)], and questions the validity of his conclusions. G. W. DE T.

1855. *Statement of the Concentration of a Solution.* **H. J. Hamburger.** (Zeitschr. Phys. Chem. 47. pp. 495–496, March 15, 1904.)—The author wants to state the total concentration of an electrolytic solution, including molecules and ions, as so and so many "molions." F. G. D.

1856. *Formation of Magnetic Oxide of Iron.* **J. Donau.** (Monatsheft d. Chemie, 25. pp. 181–187, 1904.)—When metallic iron in the form of fine wire is heated in a current of carbon dioxide at 1,100–1,200° C., the protosesquioxide of iron is produced, which is similar in appearance, density, and hardness, as well as in its magnetic properties, with natural magnetite. A small amount of moisture in the carbon dioxide has a favourable influence on the crystalline condition of the oxide. L. H. W.

1857. *Spontaneous Oxidation of Sodium Sulphite in Air.* **A.** and **L. Lumière** and **Seyewetz.** (Photog. Mittheil. 41. pp. 101–104, and pp. 117–120, 1904.)—Although dry sodium sulphite (anhydrous) does not alter in air, even up to 100°, if the atmosphere is very damp a slow oxidation is found to take place, the oxidation being more rapid the less concentrated the solution, and whether the solution is cold or at the boiling-point. L. H. W.

1858. *An Interesting Reaction of Copper Salts.* **E. Knecht.** (Manchester Lit. and Phil. Soc., Mem. 48. 9. pp. 1–4, March, 1904.)—The author finds that when a solution of titanous sulphate is added to the solution of a copper salt metallic copper is precipitated, and shows that this can be made use of for the detection of very small quantities of copper, using reflected light to distinguish the precipitate. Titanous chloride does not precipitate mercury from mercuric chloride in the cold, but does so on heating. A. F.

1859. *Hydrolysis and Synthesis of Fatty Esters by Platinum Black.* **H. Neilson.** (Amer. Journ. Physiol. 10. pp. 191–200, 1903.)—Platinum black is found to have a very similar action to lipase in hydrolysing ethyl butyrate, the hydrolysis increasing with the time and with the amount of inorganic ferment present, though not directly proportional to either. Temperature also influences the activity, the best hydrolysis being obtained at about 50° C., but the reaction is independent of the concentration of the ethyl butyrate. Most antiseptics diminish the activity of the platinum, hydroyanic acidc preventing it altogether, but sodium fluoride, which is very destructive to lipae, has much less effect upon platinum black. Ethyl butyrate may also be synthesised from butyric acid and alcohol by means of platinum, the synthesis taking place, however, to a much less extent than hydrolysis. W. H. SI.

1860. *Method of Preparation of Metallic Silicides, and its Application to the Study of Manganese Silicides.* **P. Lebeau.** (Annal. Chim. Phys. 1. pp. 553–574, April, 1904.)—The author shows that his method for the preparation of silicides of iron and cobalt [see Abstracts Nos. 516 (1902) and 528 (1903)], by fusion of the metal with copper silicide, is capable of general application to metals of the iron group, while with Ag, Zn, Sn, and Al the copper forms alloys, and silicon is liberated. By this method three crystalline manganese silicides have been prepared, corresponding to the formulæ $SiMn_2$, $SiMn$, and Si_2Mn, the chief properties of which are given. No compound was obtained corresponding to the formula $SiMn_5$ as found by Wöhler. W. H. SI.

1861. *On the Hydrates of Methyl Alcohol and of Acetone.* **E. Varenne** and **L. Godefroy.** (Comptes Rendus, 138. pp. 990–992, April 18, 1904.)—The author has employed the chronostiliscope of Varenne [see Abstract No. 465 (1904)] for measuring the viscosity (rate of flow) of various mixtures of methyl alcohol and water and of acetone and water, and from the curves obtained draws the conclusion that methyl alcohol forms six hydrates and acetone three hydrates. [See also Abstract No. 424 (1904).] A. F.

1862. *Chemical Potential and Electromotive Force.* **W. D. Bancroft.** (Journ. Phys. Chem. 7. pp. 416–427, June, 1903.)—This is a mathematical paper in which the author amplifies the results given by Gibbs at the end of his paper on the Equilibrium of Heterogeneous Substances, and shows that whilst Gibbs' equations lead to the results obtained by Nernst and Planck in later years, they are more general, and possess the merit of absolute accuracy, as they involve no assumptions as to validity of the gas laws, &c., &c. F. G. D.

1863. *Form Assumed by Mercuric Iodide in Separating from Solution.* **D. Gernez.** (Comptes Rendus, 136. pp. 1322–1324, June 2, 1903.)—The author has caused the separation of mercuric iodide from solutions in a great variety of solvents, both by evaporation of the solvent as well as by cooling of supersaturated solutions, at temperatures below 126° (the transition-point for red and yellow mercuric iodide), and finds that in all cases the yellow form is obtained. [See also Abstract No. 1499 (1903).] A. F.

1864. *Irregularities with Lead Anodes in Sodium Carbonate Solutions.* **K. Elbs** and **E. Stohr.** (Zeitschr. Elektrochem. 9. p. 531, June 25, 1903. Physik. Chem. Universitäts-Laboratorium, Giessen, May, 1903.)—A lead anode immersed in sodium carbonate solution is often employed in the electrolytic reduction of aromatic nitro-compounds in presence of sodium acetate. The lead generally becomes coated with a thin layer of the peroxide, but, if too much chloride is present in the sodium carbonate, a thick layer of a mixture of peroxide, chloride and carbonate forms on the lead and hinders the passage of the current. When the sodium carbonate solution is too weak and contains acetate, the peroxide falls from the lead, which becomes converted into carbonate. These difficulties may be overcome by using not less than 15 c.cm. of a cold, saturated sodium carbonate solution per amp.-hour. T. H. P.

1865. *Current Yield with Electrolytic Silver Baths for Thick Deposits.* **W. Pfanhauser.** (Zeitschr. Elektrochem. 10. pp. 68–70, Jan. 22, and p. 101, Feb. 12, 1904.)—The author maintains, as a result of further experiments, that in the case of silver baths, for thick deposits the current yield is 99 per cent., as stated in his book, "Elektro-plattierung, Galvanoplastik und Metallpolierung." Langbein (Zeitschr. Elektrochem. 9. p. 979, (1903) had criticised this statement, having found from various experiments that the yield was only 98 per cent. The current yields obtained by the author in the experiments described in the first paper are 99·997, 99·998, 99·961, and 99·999 per cent. The yields obtained in later experiments were 99·721 and 99·879 per cent. T. S. P.

1866. *Direct Hydrogenation of Aniline.* **P. Sabatier** and **J. B. Senderens.** (Comptes Rendus, 138. pp. 457–460, Feb. 22, 1904.)—On passing aniline vapour mixed with excess of hydrogen over nickel heated to 190°, the hydrogen is absorbed, ammonia evolved, and a mixture of nearly equal proportions of cyclohexylamine, dicyclohexylamine, and cyclohexylaniline obtained. The properties of these compounds, the two latter of which are new, are given. Similar results were obtained with diphenylamine and hydrogen. T. H. P.

1867. *Effect of Ions on the Decomposition of Hydrogen Peroxide by Platinum Black.* **C. H. Neilson** and **O. H. Brown.** (Amer. Journ. Physiol., 10. pp. 225-228, 1904.) In general, the kathion has an inhibiting effect, and the anion an accelerating effect.

1868. *Density of Fluorine.* **H. Moissan.** (Comptes Rendus, 138. pp. 728-732, March 21, 1904.)—New determinations of the density of fluorine at 0° and 760 mm. pressure give the values 1·298, 1·319, 1·313, and 1·312, the mean being 1·31; this agrees well with the theoretical density, 1·319, derived from the atomic weight. Hence gaseous fluorine contains no free atoms. T. H. P.

1869. *Kathodic Polarisation in Dilute Sulphuric Acid.* **J. Tafel.** (Zeitschr. Elektrochem. 8. pp. 604-606; Discussion, pp. 606-607, Aug. 21, 1902, Paper read before the German Electrochemical Society, May 9 and 10, 1902, at Würzburg.)—To measure the magnitude of the kathodic polarisation under different conditions, advantage was taken of the fact that with a large polished platinum anode and a smaller platinised platinum kathode the p.d. between the electrodes very rapidly takes up a steady value at any given current-density and remains constant for hours together, the variations under favourable conditions being only a few thousandths of a volt. The method employed consisted in measuring with a voltmeter the p.d. between a platinum crucible (anode) and a cylindrical kathode of platinised platinum with hemispherical end, for a given current density, and then substituting a precisely similar kathode of lead, silver, &c., and again measuring the p.d. with the same current. One example is given, showing the influence of the magnitude of the kathodic polarisation on the rate of reduction of caffein, but the bulk of the observations is reserved for a later communication. T. M. L.

1870. *Electrolysis of the Sulphides of the Alkaline Earths.* **A. Brochet** and **G. Ranson.** (Comptes Rendus, 136. pp. 1195-1197, May 18, 1903.)—The authors have studied the electrolysis of solutions of barium sulphide, without using a diaphragm, and have obtained results similar to those which they obtained with alkali sulphides. [See Abstract No. 939 (1904).] A. F.

1871. *Polarisation of Electrodes.* **E. Rothé.** (Annal. Chim. Phys. 1. pp. 215-288, Feb., 1904.)—This is a theoretical paper in which the author discusses the polarisation phenomena observed under various conditions and their theoretical explanation according to different investigators. The condenser theory, the thermodynamic theory, the notion of solution pressure, and the electro-chemical theory are all treated of. The author's idea is that in polarisation a large number of phenomena occur, especially the formation of a double layer of ions and the formation of secondary chemical compounds, which tend to decompose when no current is passing. Of special importance are the chemical reactions taking place before the appearance of visible electrolysis at the electrodes. The opinion is expressed that valuable results regarding the mechanism of polarisation would be obtained from a study of the variable polarisation or of the variable current produced from a constant current. [See also next Abstract.] T. H. P.

1872. *Polarisation of Platinum, Gold, and Palladium Electrodes.* **E. Rothé.** Annal. Chim. Phys. 1. pp. 289-337, March, 1904.)—A further study [compare preceding Abstract] of the polarisation of platinum, gold, and palladium electrodes in acidified water by means of (1) the galvanometer, (2) the bifilar oscillograph of Blondel, and (3) the ballistic method, shows that a voltameter with electrodes of the precious metals acts as a true secondary cell for e.m.f.'s far less than those producing visible electrolysis. For such small e.m.f.'s there are produced, not merely electric charges on the electrodes but true chemical reactions. T. H. P.